NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600

Donald Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Jim Elliott
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-6256)

Ray Villard
Space Telescope Science Institute, Baltimore, MD
(Phone: 410/338-4562)

For Release
January 9, 1994

NOTE TO EDITORS: N95-1

TWO HUBBLE IMAGES SHOW AFTERMATH OF VIOLENT COSMIC EVENTS

Two new images taken by NASA's Hubble Space Telescope (HST) provide details of the results from two violent cosmic events. One images shows a single star which blew off its outer shell 1,000 years ago and the other shows the unusual result of two galaxies which collided eons ago. Both images were taken with the Wide Field and Planetary Camera-2 and will be available January 10 and 11, respectively.

"Ring World" Colliding Galaxies (image available January 10)

This image shows a rare and spectacular head-on collision between two galaxies located 500 million light-years away in the constellation Sculptor. The galaxy, called the Cartwheel Galaxy, is surrounded by a ring-like feature which is a direct result of a smaller intruder galaxy -- possibly one of two objects to the right of the ring -- which careened through the core of the Cartwheel galaxy. The collision sent a ripple of energy into space, plowing gas and dust in front of it. The ring is now a stellar birthplace for at least several billion new stars and is so large the entire Milky Way Galaxy would fit inside. Hubble resolves bright blue knots that are gigantic clusters of newborn stars and immense loops and bubbles blown into space by exploding stars (supernovae) going off like a string of firecrackers.

"Cat's Eye Nebula" (image available January 11)

A fascinating and colorful preview of the possible eventual fate of Earth's sun is evident in the Hubble image of a planetary nebula, named NGC 6543 but nicknamed the "Cat's Eye Nebula," which is in the last stages of its life after an explosion about 1,000 years ago blew away the outer gas layers of the star.

-more-

This image reveals surprisingly intricate structures including concentric gas shells, jets of high-speed gas and unusual shock-induced knots of gas. The nebula, located 3,000 light-years away in the northern constellation Draco, is a visual "fossil record" of the dynamics and late evolution of a dying star.

Images are available to news media representatives by sending a fax request on letterhead to the NASA Headquarters Broadcast and Imaging Branch at 202/358-4333. Photo numbers are:

"Cats Eye" Planetary Nebula NGC 6543:
B&W: 95-H-23 Color: 95-HC-23

"Ring World" Galaxy:
B&W: 95-H-24 Color: 95-HC-24

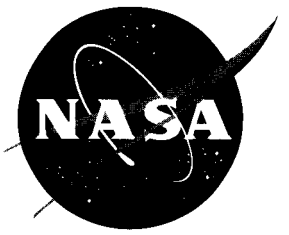
- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600



For Release

January 9, 1995

Debra J. Rahn
Headquarters, Washington, DC
(Phone: 202/358-1639)
(Fax: 202/358-2983)

Mark Hess
Headquarters, Washington, DC
(Phone: 202/358-1778)
(Fax: 202/358-2887)

NOTE TO EDITORS: 95-2

NEWS MEDIA COVERAGE OF MIR 18 LAUNCH

News media representatives planning to cover U.S. Astronaut Norman Thagard's launch aboard a Soyuz spacecraft from Baikonur to the Russian Mir Space Station on Feb. 14, 1995, must obtain Russian Government approvals. In order to obtain the necessary approvals, fax the following information to one of the above contacts no later than Jan. 20, 1995:

Full Name
Title and Organization
Passport Number and Expiration Date
Place of Birth
Date of Birth
Telephone Number
Fax Number

News media representatives who plan to bring any communications equipment with them to Baikonur will need to obtain clearance of the frequencies directly from Lt. Alexanderm A. Borovikov, External Relations Department, Russian Space Forces, Moscow, Russia, on 7 095 333 81 33, with a copy to Debra Rahn, NASA Headquarters.

News media representatives planning to cover Astronaut Thagard's launch, docking and other mission events from the Mission Control Center (MCC-M), Kaliningrad (Moscow region), Russia, need to provide the same information as above to Debra Rahn by Feb. 1, 1995, to obtain press accreditation at MCC-M.

-more-

If news media representatives wish to install telephones or other equipment at MCC-M, please fax your requirements directly to Mr. Vsevolod P. Latyshev, Head, Information Department, MCC-M, on 7 095 274-0025 with a copy to Debra Rahn, NASA Headquarters.

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

For Release

January 11, 1995

VIDEO ADVISORY: V95-1

NASA TV TO PROVIDE NEW IMAGE FROM HUBBLE SPACE TELESCOPE

NASA Television will provide a video news release showing an image of a planetary nebula, nicknamed the "Cat's Eye Nebula." The image was taken by the Hubble Space Telescope's Wide Field and Planetary Camera-2. The image shows the Cat's Eye Nebula in the last stages of its life after an explosion about 1,000 years ago blew away the outer gas layers of the star. The Cat's Eye Nebula reveals suprisingly intricate structures, including concentric gas shells, jets of high-speed gas and unusual shock-induced knots of gas. Located 3,000 light-years away in the northern constellation Draco, the Cat's Eye Nebula is a visual "fossil record" of the dynamics and late evolution of a dying star. The VNR is produced by the Space Telescope Science Institute, Baltimore, MD.

Slug: *HUBBLE PROBES THE HISTORY OF A DYING STAR*
TRT: 8:27
NASA Public Affairs Contact: Donald Savage, 202/358-1730
Space Telescope Science Institute Contact: Ray Villard, 410/338-4562
Air Date: January 11, 1995
Transmission times: 12:10pm, 4:10pm, 8:10pm EST.

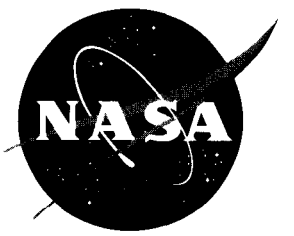
NASA Television is broadcast on Spacenet 2, transponder 5, Channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 Megahertz, with audio on 6.8 Megahertz.

-end-

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600



Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

Dom Amatore
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/544-6533)

For Release
January 12, 1995

RELEASE: 95-1

REUSABLE LAUNCH VEHICLE NOTICES ISSUED

NASA today issued two Cooperative Agreement Notices (CANs) requesting proposals for the development of technology demonstrators for a Reusable Launch Vehicle (RLV) program.

The goal of the RLV technology program is the continued lowering of the cost of access to space to promote the creation and delivery of new space services and other activities that will improve economic competitiveness. The Program will implement the recently-released National Space Transportation Policy, specifically Section III, paragraph 2(b): "Research shall be focussed on technologies to support a decision, no later than December 1996, to proceed with a sub-scale flight demonstration which would prove the concept of single-stage to orbit."

Sponsored by NASA's Office of Space Access and Technology (OSAT), the "X-34" CAN is intended to: (1) stimulate the joint industry/Government-funded development of a small reusable, or partially-reusable, booster that has potential application to commercial launch vehicle capabilities and which will provide significantly reduced mission costs for placing small payloads into a low Earth orbit and, (2), demonstrate technologies that have application to future reusable launch vehicle systems. Some of these technologies may be demonstrated as a part of the basic booster design and some through test bed application of the booster for demonstration of alternate technologies.

The development schedule should support flight tests beginning in late-1997, orbital launch by mid-1998 and test bed applications later in 1998. Offerers must submit proposals in response to this CAN by Feb. 24, 1995. NASA may fund one or more proposals and industry cost-sharing contributions will be required to match on a cumulative basis, as a minimum, the NASA funds provided directly to the offerer under the resulting Cooperative Agreement. The current expected NASA program funding for the X-34, through FY 1999, is $70 million.

-more-

The second CAN released today is intended to stimulate the joint industry/government co-funded concept definition and design of a technology demonstrator vehicle, designated the "X-33," followed by the design/demonstration of a competitively selected concept or concepts.

The X-33 must adequately demonstrate the key design and operational aspects of a reusable space launch system so as to reduce the risk of developing such a commercially-viable launch system.

The performance period for Phase I, the concept definition/design phase, is 15-months. The results of Phase I will provide the basis for a White House decision on whether or not to proceed with Phase II, which includes design, building and flight demonstration of the X-33. Pending the decision to proceed, Phase II would initiate by the end of FY 1996 and continue through the end of the decade. The results of Phase II would be utilized by the Government and private sector to decide whether or not to proceed with development of an operational next-generation reusable launch system.

Offerers must submit proposals for Phase I/X-33 activities by Feb. 24, 1995. Multiple awards for Phase I are planned during which each participant shall mature its total X-33 business investment strategies and planning, operations planning and vehicle design and analysis with detail sufficient to permit competitive selection of industry partner(s) and their X-33 design concept(s) at the end of the period.

Significant cost-sharing by industry is anticipated during Phase I. Although no minimum percentage is specified for Phase I, NASA reserves the right to specify minimum sharing requirements for Phases II and III. Current expected funding by the government during Phase I (in FY 1995) is $18 million. As a guide for the preparation of proposals, the potential level of government funding estimated to be available through FY 1999 for the X-33 is approximately $650 million.

Participation in this program is open to all categories of organizations, both domestic and foreign. Organizations include large businesses, small businesses, small disadvantaged businesses, educational institutions, non-profit organizations, NASA Centers and Federal, State and local government agencies.

The Office of Space Access and Technology conducts space research and development through sponsorship of technology programs conducted at NASA Field Centers, in U.S. industry, and in American universities. The OSAT Space Transportation Division supports these activities by sponsoring the development of the next generation RLV technologies. NASA's RLV Technology Program will accelerate the development and application of new space launch

technologies and operational concepts to contribute to the continuing commercialization of the national space launch industry.

- end -

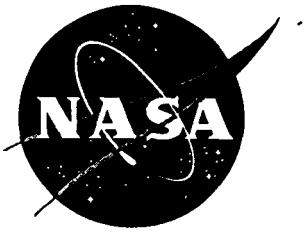
NOTE TO EDITORS: Copies of both CANs are available for review in the NASA Headquarters and Marshall Space Flight Center Newsrooms (phones: 202/358-1600 and 205/544-0034, respectively). Further administrative and contractual information may be obtained from the Marshall Space Flight Center, Huntsville, AL, at 205/544-0381. Additional technical information may be obtained, also from Marshall, at 205/544-0366. The CANs are available over the internet world wide web at "http://sunwks.msfc.nasa.gov/coop/coophome.html"

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600



For Release

Debra Rahn
Headquarters, Washington, DC
(Phone: 202/358-1639)

Kyle Herring
Johnson Space Center, Houston
(Phone: 713/483-5111)

January 13, 1995

RELEASE: 95-3

TWO INTERNATIONAL CANDIDATES TO JOIN 1995 ASTRONAUT CLASS

Japanese astronaut Takao Doi, Ph.D., representing the National Space Development Agency of Japan, and Canadian astronaut David S. Williams, M.D., of the Canadian Space Agency, will join the newest group of astronaut candidates as mission specialists.

Their selection brings to 21 the number of candidates selected for training as part of the astronaut class of 1995. The group consists of 11 mission specialists and 10 pilot candidates.

The candidates will report to the Johnson Space Center in March 1995 to begin a year of training and evaluation, followed by technical assignments within the Astronaut Office to further prepare them for assignment to Shuttle flight crews.

Biographical data on the two international astronauts follows:

NAME:	Takao Doi, Ph.D.
BIRTHDATE/PLACE:	September 18, 1954 - Minamitama-gun, Tokyo, Japan
EDUCATION:	Ousaka-phu, Mikunigaoka High School 1973 Bachelor of Engineering, University of Tokyo 1978 Master of Engineering, University of Tokyo 1980 Doctorate, Aerospace Engineering, Univ. of Tokyo 1983
CURRENT POSITION:	Japanese astronaut
MARITAL STATUS:	Hitomi Abe, Toukamachi, Niigata, Japan

-more-

NAME:	Dafydd (David) Rhys Williams, M.D.
BIRTHDATE/PLACE:	May 16, 1954 - Saskatoon, Saskatchewan
EDUCATION:	Attended High School in Beaconsfield, Quebec BS Biology, McGill University, Montreal 1976 MS Physiology Department, Doctorate of Medicine, and Master of Surgery from McGill University 1983
CURRENT POSITION:	Canadian astronaut
MARITAL STATUS:	Cathy Fraser, Point-Claire, Quebec

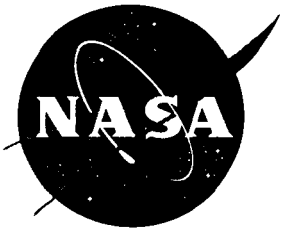
-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600



Barbara Selby
Headquarters, Washington, DC
(Phone: 202/358-1983)

Michael Mewhinney
Ames Research Center, Moffett Field, CA
(Phone: 415/604-9000)

For Release

January 13, 1995

RELEASE: 95-4

NASA TO CONDUCT LARGE-SCALE WIND TUNNEL TESTS OF X-32

Wind tunnel tests will begin this summer on the X-32, a proposed 21st Century supersonic jet fighter.

Up to three eight-week tests of the X-32 Common Affordable Lightweight Fighter will be conducted at NASA's Ames Research Center, Moffett Field, CA, in the National Full-Scale Aerodynamics Complex (NFAC) 80-foot by 120-foot wind tunnel. One additional eight-week test is planned at the NFAC's Outdoor Aerodynamic Research Facility. The X-32 could be introduced into service around 2010.

"The idea is to have a conventional take-off and landing aircraft that could be configured for short take-offs and vertical landings," said Douglas Wardwell, an Ames aerospace engineer. The short take-offs and vertical landings version of the new aircraft could share a common fuselage and engine with the conventional take-off and landing aircraft, but use a powered-lift propulsion system for vertical landings.

Tests of the proposed $120 million X-32 are part of the Joint Advanced Strike Technology program. The goal is to demonstrate technologies and operational concepts to make military aircraft more affordable. The program's participants are the Advanced Research Projects Agency, the Department of the Navy and Department of the Air Force.

NASA will provide wind tunnel time and personnel to conduct requested tests at NASA facilities and also will provide technical expertise to support the program.

more-

Wind tunnel tests of small-scale models of the X-32 already have been conducted at many test facilities including Ames and at NASA's Langley Research Center, Hampton, VA, and Lewis Research Center, Cleveland, OH.

NASA plans to test large-scale conceptual models of the X-32 designed by McDonnell Douglas Aerospace Co., St. Louis, MO, Lockheed Advanced Development Co., Palmdale, CA, and possibly Boeing Defense and Space Group, Seattle, WA. The X-32 tests are scheduled to continue through the summer of 1996.

Test engineers have made preliminary predictions that some of the model tests at the highest power settings could generate noise levels up to 83 decibels for periods not exceeding two hours per day at the residential property line closest to the wind tunnel. An 83 decibel noise level is comparable to the noise heard by a person operating a lawn mower or food blender.

However, during a typical test day, engineers say nearby residents are expected to experience outside noise levels of no more than 60 decibels.

Because of the potential for noise generated by some of the tests at Ames, NASA is preparing an environmental impact statement (EIS) for the X-32 tests. As part of the project's EIS process, public meetings will be held to inform local residents of the tests and to listen to comments and environmental concerns about the proposed plan. The first meeting is currently being planned for early February. A Notice of Intent to prepare an EIS for the project is being published in the Federal Register.

-end-

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600

For Release

Sarah Keegan
Headquarters, Washington, DC
(Phone: 202/358-1902)

January 18, 1995

NOTE TO EDITORS: N95-3

NASA KICKS OFF SEMINAR SERIES

The first public seminar in a series designed to help shape a unified agenda for the future of NASA's space program will be held on Jan. 23 at NASA Headquarters, Washington, DC. "Signs of Life," featuring Dr. Lynn Margulis, University of Massachusetts, and Dr. Leslie Orgel, the Salk Institute for Biological Studies, will explore the definitions of life and how we can identify it elsewhere.

The program will begin at 6:00 pm EST in NASA's west lobby auditorium, 300 E St., SW, Washington, DC.

The seminar series, initiated by NASA Chief Scientist Dr. France Anne Cordova and introduced on Jan. 23 by NASA Administrator Daniel S. Goldin, will be scheduled over the next year to consider fundamental questions that bear on NASA's greatest challenges.

Media representatives who wish to cover the event with cameras should notify (by 2:00 pm EST on Jan. 23) Sarah Keegan, NASA Public Affairs, 202/358-1902.

-end-

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600

Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

For Release
January 18, 1995

NOTE TO EDITORS: N95-4

FIRST SHUTTLE LAUNCH OF 1995 SET FOR FEBRUARY 2

NASA managers today set February 2, 1995, as the official launch date for Space Shuttle Discovery on Mission STS-63. The Feb. 2 launch date assumes successful completion of thruster changeout work scheduled to be finished later this week.

The flight will feature a rendezvous with the Russian Space Station Mir in a dress rehearsal of missions that will follow later in 1995. In addition, the mission will see the third flight of the commercial SPACEHAB facility in which a number of microgravity research experiments will be conducted. Discovery's crew also will deploy and retrieve a free-flyer astronomy payload and two crewmembers will perform a five-hour spacewalk.

Launch of Discovery on Feb. 2 is currently planned for approximately 12:49 a.m. EST from Kennedy Space Center's Launch Complex 39-B. The actual launch time is expected to vary by several minutes based on new Mir state vectors for Shuttle rendezvous phasing requirements which will be updated closer to launch. The available window to launch Discovery is approximately 5 minutes each day. The STS-63 mission is scheduled to last just over 8 days. A 12:49 a.m. launch on Feb. 2 would produce a landing at Kennedy Space Center's Shuttle Landing Facility on Feb. 10 at approximately 6:15 a.m. EST.

The STS-63 crew will be commanded by James D. Wetherbee who will be making his third Shuttle flight. Eileen M. Collins will serve as pilot. She will be making her first spaceflight, becoming the first woman to pilot a Space Shuttle. The four STS-63 mission specialists aboard Discovery will include Bernard A. Harris Jr., the STS-63 Payload Commander and Mission Specialist-1 who will be making his second flight; Michael C. Foale, Mission Specialist-2 who will be making his third flight; Janice Voss, Mission Specialist-3 who will be making her second flight; and Cosmonaut Vladimir Georgievich Titov, Mission Specialist-4, who will be making his first flight aboard the Space Shuttle and fourth flight into space.

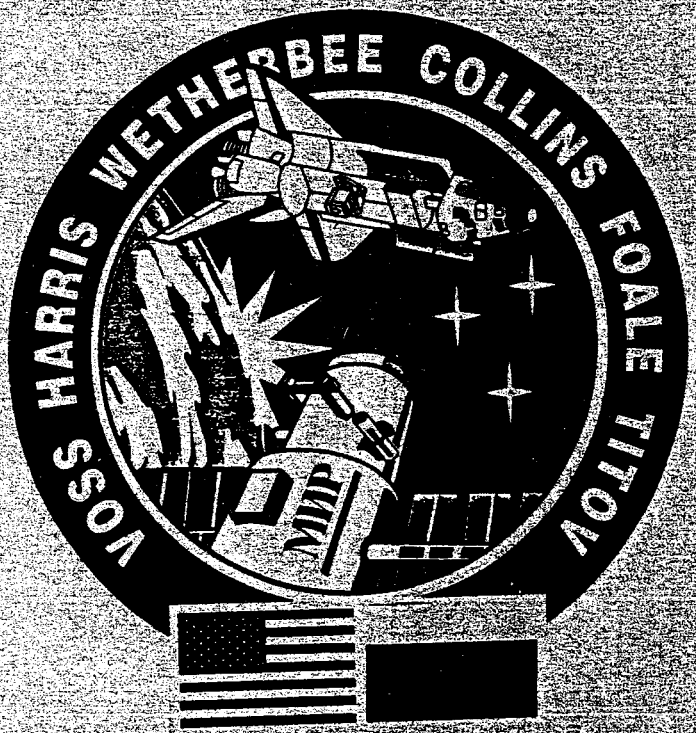
-end-

95-5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-63

PRESS KIT
FEBRUARY 1995



SHUTTLE-MIR RENDEZVOUS
SPACEHAB-3
SPARTAN-204

PUBLIC AFFAIRS CONTACTS

For Information on the Space Shuttle

Ed Campion Headquarters, Wash., DC	Policy/Management	202/358-1778
Rob Navias Johnson Space Center	Mission Operations Astronauts	713/483-5111
Bruce Buckingham Kennedy Space Center, FL	Launch Processing KSC Landing Information	407/867-2468
June Malone Marshall Space Flight Center, Huntsville, AL	External Tank/SRBs/SSMEs	205/544-0034
Cam Martin Dryden Flight Research Center, Edwards, CA	DFRC Landing Information	805/258-3448

For Information on STS-63 Experiments & Activities

Rob Navias Johnson Space Center	Mir Rendezvous & Fly Around	713/483-5111
Debra Rahn Headquarters, Wash., DC	International Cooperation	202/358-1639
Jim Cast Headquarters, Wash., DC	SPACEHAB-3	202/358-1779
Mike Braukus Headquarters, Wash., DC	SSCE	202/358-1979
Don Savage Headquarters, Wash., DC	SPARTAN-204	202/358-1547
Tammy Jones Goddard Space Flight Center, Greenbelt, MD	CGP/ODERACS-II	301/286-5566

CONTENTS

RELEASE: 95-5

RENDEZVOUS WITH RUSSIAN SPACE STATION HIGHLIGHTS FIRST SHUTTLE FLIGHT OF 1995

A significant step in the growing cooperative effort between the United States and Russia will take place during NASA's first Shuttle mission of the year when Discovery and her crew perform a rendezvous and fly around of the Russian Space Station Mir.

In addition, the STS-63 mission will see the third flight of the commercial SPACEHAB facility in which a number of microgravity research experiments will be conducted. Discovery's crew also will deploy and retrieve a free-flyer astronomy payload and two crew members will perform a five hour spacewalk.

The STS-63 crew will be commanded by James D. Wetherbee who will be making his third Shuttle flight. Eileen M. Collins will serve as pilot. She will be making her first spaceflight, becoming the first woman to pilot a Space Shuttle. The four mission specialists aboard Discovery will include Bernard A. Harris Jr., the Payload Commander and Mission Specialist-1 who will be making his second flight; Michael C. Foale, Mission Specialist-2 who will be making his third flight; Janice Voss, Mission Specialist-3 who will be making her second flight; and Cosmonaut Vladimir Georgievich Titov, Mission Specialist-4 who will be making his first flight aboard the Shuttle and fourth flight into space.

Launch of Discovery is currently targeted for February 2, 1995, at approximately 12:49 a.m. EST from Kennedy Space Center's Launch Complex 39-B. The actual launch time is expected to vary by several minutes based on new Mir state vectors for Shuttle rendezvous phasing requirements which will be updated closer to launch. The available window to launch Discovery is approximately 5 minutes each day. The STS-63 mission is scheduled to last 8 days, 6 hours, 13 minutes. A 12:49 a.m. launch on February 2 would produce a landing at Kennedy Space Center's Shuttle Landing Facility on February 10 at approximately 6:15 a.m. EST.

The Discovery crew's primary objective is to rendezvous with the Russian Space Station Mir in a dress rehearsal of missions that will follow later in 1995. The rendezvous is scheduled to take place on the fourth day of the mission and will serve to test the systems and techniques currently planned for the first Shuttle docking mission with Atlantis on Mission STS-71, currently scheduled for launch in June 1995.

The rendezvous will validate a number of flight techniques that will be employed on subsequent docking missions. These techniques include the use of precision flying as the Shuttle closes in on Mir, validating the use of a centerline camera for targeting the docking mechanism on Mir, verifying the absence of plume effects, demonstrating VHF radio communications, inspecting the Mir complex through photographs and video, and demonstrating the joint operations between Mission Control Centers in Houston, and Kaliningrad, Russia.

While the fly-around will provide valuable information for flight designers planning the docking missions, the completion of these objectives is not mandatory for the STS-71 mission.

The STS-63 mission will see the third flight of the SPACEHAB module, a pressurized, commercially-developed space research laboratory located in the forward end of Discovery's cargo bay. The SPACEHAB module significantly increases the pressurized working and storage volume normally available aboard the Shuttle. Over 20 SPACEHAB-3 experiments, sponsored by NASA's Offices of Space Access and Technology and Life and Microgravity Sciences and Applications together with the Department of Defense, represent a diverse cross-section of technological, biological and other scientific disciplines. These experiments were developed for flight by an equally-diverse complement of university, industry and government organizations nationwide.

Also being carried on Discovery is the Shuttle Pointed Autonomous Research Tool for Astronomy-204 (SPARTAN-204) designed to obtain data in the far ultraviolet region of the spectrum from diffuse sources of light.

Spartan 204's mission will occur in two distinct phases. The first phase will have the crew grapple the Spartan spacecraft with the robot arm and unberth it from its support structure. The crew then will conduct scientific observations by pointing Spartan at the Shuttle's tail to observe surface glow. It also will point at a primary Reaction Control System thruster to obtain far ultraviolet spectrographs of a thruster firing.

After the Mir rendezvous portion of the mission is complete, a crew member will again use the robot arm to lift the Spartan spacecraft from the payload bay and release it over the side of the Shuttle. It will be deployed from the Shuttle so that it can operate independently. For approximately 40 hours, Spartan 204's instrument will observe various celestial targets. Discovery will then rendezvous with Spartan 204 and the robot arm will be used to retrieve the payload.

The STS-63 mission will continue laying the groundwork for future space activities when Mission Specialists Mike Foale and Bernard Harris perform an almost five-hour spacewalk to test spacesuit modifications and practice handling large objects in microgravity.

The spacewalk has two specific objectives: to evaluate modifications to the spacesuits that provide astronauts with better thermal protection from cold and to perform several mass handling exercises in a series of activities designed to increase NASA's experience base as it prepares for the on-orbit assembly of the International Space Station.

Also being carried aboard Discovery will be a series of experiments that are part of the Hitchhiker Program, managed at NASA's Goddard Space Flight Center, Greenbelt, MD. The program is designed for customers who wish to fly quick-reaction and low-cost experiments on the Shuttle.

The first of four Hitchhiker missions scheduled for this year is CGP/ODERACS-II and will be aboard STS-63. This payload's acronym stems from the following experiments: Cryo System Experiment (CSE) whose overall goal is to validate and characterize the on-orbit performance of two thermal management technologies that comprise a hybrid cryogenic system; the Shuttle Glow (GLO-2) experiment which will investigate the mysterious shroud of luminosity, called the "glow phenomenon" observed by astronauts on past Shuttle missions; and the Orbital Debris Radar Calibration System-II (ODERACS-II) experiment which will provide a vehicle whereby small calibration targets are placed in Low Earth Orbit (LEO) for the purpose of calibrating ground-based radar and optical systems so that they may more accurately provide information regarding small debris in LEO.

The Solid Surface Combustion Experiment (SSCE) being flown on the Discovery is a continuing effort to study how flames spread in a microgravity environment. Comparing data on how flames spread in microgravity with knowledge of how flames spread on Earth may contribute to improvements in all types of fire safety and control equipment. This will be the eighth time SSCE has flown aboard the Shuttle, testing the combustion of different materials under different atmospheric conditions.

STS-63 will be the 20th flight of Discovery and the 67th flight of the Space Shuttle System.

- end -

MEDIA SERVICES INFORMATION

NASA Television Transmission

NASA Television is available through Spacenet-2 satellite system, transponder 5, channel 9, at 69 degrees West longitude, frequency 3880.0 MHz, audio 6.8 Megahertz.

The schedule for television transmissions from the Orbiter and for mission briefings will be available during the mission at Kennedy Space Center, FL; Marshall Space Flight Center, Huntsville, AL; Dryden Flight Research Center, Edwards, CA; Johnson Space Center, Houston; NASA Headquarters, Washington, DC; and the NASA newscenter operation at Mission Control-Moscow. The television schedule will be updated to reflect changes dictated by mission operations.

Television schedules also may be obtained by calling COMSTOR 713/483-5817. COMSTOR is a computer data base service requiring the use of a telephone modem. A voice update of the television schedule is updated daily at noon Eastern time.

Status Reports

Status reports on countdown and mission progress, on-orbit activities and landing operations will be produced by the appropriate NASA newscenter.

Briefings

A mission press briefing schedule will be issued prior to launch. During the mission, status briefings by a Flight Director or Mission Operations representative and when appropriate, representatives from the payload team, will occur at least once per day. The updated NASA television schedule will indicate when mission briefings are planned.

Access by Internet

NASA press releases can be obtained automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service.

Informational materials also will be available from a data repository known as an anonymous FTP (File Transfer Protocol) server at ftp.pao.hq.nasa.gov under the directory /pub/pao. Users should log on with the user name "anonymous" (no quotes), then enter their E-mail address as the password. Within the /pub/pao directory there will be a "readme.txt" file explaining the directory structure.

Access by fax

An additional service known as fax-on-demand will enable users to access NASA informational materials from their fax machines. Users calling (202) 358-3976 may follow a series of prompts and will automatically be faxed the most recent Headquarters news releases they request.

Access by Compuserve

Users with Compuserve accounts can access NASA press releases by typing "GO NASA" (no quotes) and making a selection from the categories offered.

STS-63 QUICK LOOK

Launch Date/Site:	Feb. 2, 1995/KSC Pad 39B
Launch Time:	12:49 a.m. EST *
Launch Window:	5 minutes
Orbiter:	Discovery (OV-103) - 20th flight
Orbit/Inclination:	170 nautical miles/51.6 degrees
Mission Duration:	8 days, 6 hours, 13 minutes
Landing Time/Date	6:15 a.m. EST, Feb. 10, 1995
Primary Landing Site:	Kennedy Space Center, Florida
Abort Landing Sites:	Return to Launch Site - KSC Transoceanic Abort Landing - Zaragoza, Spain Moron, Spain, Ben Guerir, Morocco Abort Once Around - KSC
Crew:	Jim Wetherbee, Commander (CDR) Eileen Collins, Pilot (PLT) Bernard Harris, Payload Commander, Mission Specialist 1 (MS 1) C. Michael Foale, Mission Specialist 2 (MS 2) Janice Voss, Mission Specialist 3 (MS 3) Vladimir Titov, Mission Specialist 4 (MS 4)
Extravehicular Crew members:	Foale (EV 1), Harris (EV 2)
Cargo Bay Payloads:	SPACEHAB-03 SPARTAN-204 CGP-ODERACS-2 (Cryo Systems Experiment/Orbital Debris Radar Calibration Spheres) ICBC (IMAX Cargo Bay Camera)
Middeck Payloads:	SSCE (Solid Surface Combustion Experiment)

* Actual launch time is expected to vary by several minutes based on new Mir state vectors for Shuttle rendezvous phasing requirements which will be updated closer to launch.

Developmental Test Objectives/Detailed Supplementary Objectives:

DTO 301D:	Ascent Structural Capability Evaluation
DTO 305D:	Ascent Compartment Venting Evaluation
DTO 306D:	Descent Compartment Venting Evaluation
DTO 307D:	Entry Structural Capability
DTO 312:	External Tank Thermal Protection System Performance
DTO 319D:	Orbiter/Payload Acceleration and Acoustics Data
DTO 414:	APU Shutdown Test
DTO 524:	Landing Gear Loads and Brake Stability Evaluation
DTO 623:	Cabin Air Monitoring
DTO 671:	EVA Hardware for Future Scheduled EVA Missions
DTO 672:	EMU Electronic Cuff Checklist
DTO 700-2:	Laser Range and Range Rate Device
DTO 700-5:	Payload Bay Mounted Rendezvous Laser
DTO 700-7:	Orbiter Data for Real-Time Navigation Evaluation
DTO 805:	Crosswind Landing Performance
DTO 832:	Target of Opportunity Navigation Sensors
DTO 833:	EMU Thermal Comfort Evaluations
DTO 835:	Mir Approach Demonstration
DTO 836:	Tools for Rendezvous and Docking
DTO 838:	Near Field Targeting and Reflective Alignment System
DTO 1118:	Photographic and Video Survey of Mir Space Station
DTO 1210:	EVA Operations Procedures/Training
DSO 200B:	Radiobiological Effects
DSO 201B:	Sensory-Motor Investigations
DSO 204:	Visual Observations from Space
DSO 327:	Shuttle-Mir VHF Voice Link Verification
DSO 483:	Back Pain Pattern in Microgravity
DSO 484:	Assessment of Circadian Shifting in Astronauts by Bright Light
DSO 486:	Physical Examination in Space
DSO 487:	Immunological Assessment of Crewmembers
DSO 491:	Characterization of Microbial Transfer Among Crewmembers During Flight
DSO 492:	In-Flight Evaluation of a Portable Clinical Blood Analyzer
DSO 604:	Visual-Vestibular Integration as a Function of Adaptation
DSO 608:	Effects of Space Flight on Aerobic and Anaerobic Metabolism
DSO 621:	In-Flight Use of Florinef to Improve Orthostatic Intolerance Postflight
DSO 626:	Cardiovascular and Cerebrovascular Responses to Standing Before and After Space Flight
DSO 901:	Documentary Television
DSO 902:	Documentary Motion Picture Photography
DSO 903:	Documentary Still Photography

SPACE SHUTTLE ABORT MODES

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, Orbiter and its payload. Abort modes for STS-63 include:

* Abort-To-Orbit (ATO) -- Partial loss of main engine thrust late enough to permit reaching a minimal 105-nautical mile orbit with the orbital maneuvering system engines.

* Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit of the Earth before landing at the Kennedy Space Center, FL.

* TransAtlantic Abort Landing (TAL) -- Loss of one or more main engines midway through powered flight would force a landing at either Zaragoza, Spain; Moron, Spain; or Ben Guerir, Morocco.

* Return-To-Launch-Site (RTLS) -- Early shutdown of one or more engines, and without enough energy to reach Zaragoza, would result in a pitch around and thrust back toward Kennedy until within gliding distance of the Shuttle Landing Facility.

STS-63 SUMMARY TIMELINE

Flight Day One:
Ascent
OMS-2 Burn
SPACEHAB activation
ODERACS deploy
RMS checkout

Flight Day Two:
SPACEHAB experiments
SPARTAN attached operations

Flight Day Three:
SPACEHAB experiments
Mir Rendezvous Burns

Flight Day Four:
Mir Rendezvous

Flight Day Five:
SPARTAN Deploy
SPACEHAB experiments

Flight Day Six:
EMU checkout
Flight Control Systems Checkout
SPARTAN Rendezvous Burns

Flight Day Seven:
EVA Prep
SPARTAN Rendezvous and Retrieval
EVA

Flight Day Eight:
SPACEHAB experiments
Crew News Conference
Cabin Stow

Flight Day Nine:
Deorbit Prep
Deorbit Burn
Entry
Landing

PAYLOAD AND VEHICLE WEIGHTS

Vehicle/Payload	Pounds
Orbiter (Discovery) empty and 3 SSMEs	173,716
Spacehab-03	8,765
Spacehab Support Equipment	662
Spartan 204 Airborne Support Equipment	2,409
Spartan 204 Deployable Payload	2,572
CGP/ODERACS-2	4,406
Solid Surface Combustion Experiment	139
Detailed Test/Supplementary Objectives	247
Shuttle System at SRB Ignition	4,511,889
Orbiter Weight at Landing	211,318

STS-63 ORBITAL EVENTS SUMMARY

(Based on a Feb. 2, 1995 Launch)

EVENT	MET	TIME OF DAY (EST)
OMS-2	0/00:42	1:39 AM, Feb. 2
SPACEHAB Activation	0/02:30	3:21 AM, Feb. 2
ODERACS Deploy	0/03:40	4:31 AM, Feb. 2
RMS Checkout	0/06:10	7:01 AM, Feb. 2
SPARTAN Unberth (Attached RMS Operations)	1/01:00	1:51 AM, Feb. 3
SPARTAN Berth	1/07:00	7:51 AM, Feb. 3
TI-Burn, Mir	3/10:55	11:55 AM, Feb. 5
V-Bar Arrival, Mir	3/12:35	1:26 PM, Feb. 5
30-Foot Stationkeeping	3/13:22	2:19 PM, Feb. 5
Separation Burn	3/14:45	3:36 PM, Feb. 5
SPARTAN Deploy	4/06:45	7:36 AM, Feb. 6
EMU Checkout	5/03:00	3:51 AM, Feb. 7
FCS Checkout	5/05:05	5:56 AM, Feb. 7
EVA Prep	6/00:00	12:51 AM, Feb. 8
TI-Burn, SPARTAN	6/03:35	4:26 AM, Feb. 8
SPARTAN Grapple	6/05:45	6:36 AM, Feb. 8
EVA Begins	6/06:30	7:21 AM, Feb. 8
EVA Ends	6/11:10	12:01 PM, Feb. 8
Crew News Conference	7/02:55	3:46 AM, Feb. 9
SPACEHAB Deactivation	7/07:50	8:41 AM, Feb. 9
Deorbit Burn	8/05:13	6:04 AM, Feb. 10
KSC Landing	8/06:13	7:04 AM, Feb. 10

STS-63 CREW RESPONSIBILITIES

TASK/PAYLOAD	PRIMARY	BACKUPS/OTHERS
Primary Payloads and Activities		
Mir Rendezvous Operations	Wetherbee	Collins, Foale
Spacehab-3	Harris	Titov, Voss
Spartan-204	Foale	Voss
Secondary Payloads		
CSE	Wetherbee	
GLO-2	Wetherbee	Collins
ODERACS-2	Wetherbee	Collins, Harris
AMOS	Wetherbee	Collins
CONCAP-II	Wetherbee	Collins
ICBC	Voss	Titov
MSX	Collins	Wetherbee
SSCE	Foale	Titov
CTOS	Harris	Voss
Spacehab-3 Experiments		
ASC-IV	Titov	Voss, Harris
BRIC-03	Foale	Voss
BPL-03	Wetherbee	Collins, Harris
CHARLOTTE	Titov	Voss, Harris
CHROMEX-06	Titov	Voss, Harris
CGBA-05	Titov	Harris, Voss
CPCG-VDA	Voss	Titov
CREAM-06	Wetherbee	Foale, Titov
ECLiPSE-HAB3	Harris	Titov
F-GBA	Wetherbee	Collins, Harris
GPPM-02	Voss	Harris
IMMUNE-02	Harris	Titov, Foale, Voss
NIH-C-03	Harris	Foale
PCG-STES-03	Voss	Foale, Titov
PCF-LST-03	Harris	Voss
RME-III-13	Wetherbee	Foale
SAMS-03	Foale	Wetherbee,
3-DMA	Collins	Titov
WINDEX-01	Foale	Collins, Titov

DTOs/ DSOs

DSO 200B (Radiobio Effects)	All
DSO 201B (Sensory-Motor)	Wetherbee, Collins, Harris, Foale, Voss, Titov
DSO 204 (Visual Observ.)	Titov, Foale
DSO 483 (Back Pain Pattern)	Collins, Foale, Voss
DSO 484 (Circadian Shifting)	Wetherbee, Collins, Voss, Titov
DSO 486 (Physical Exam)	Wetherbee, Collins, Harris (doctor), Foale, Voss, Titov
DSO 487 (Immun. Assessment)	All
DSO 491 (Microbial Transfer)	All
DSO 492 (Blood Analyzer)	Wetherbee, Harris, Voss
DSO 608 (Ergometer)	Harris, Foale

Photography/TV	Foale	Titov
In-Flight Maintenance	Titov	Foale
Earth Observations	Titov	Foale
RMS	Voss	Titov, Foale
Medical	Harris	Foale

SHUTTLE MIR RENDEZVOUS AND FLY AROUND

STS-63's primary objective is to rendezvous with the Russian Space Station Mir in a dress rehearsal of cooperative missions that will follow later in 1995. The approach will serve to test the systems and techniques currently planned for the first Shuttle docking mission, STS-71, currently scheduled for June 1995.

The rendezvous sequence will begin about nine hours into the mission when a reaction control system jet firing adjusts the rate at which Discovery is closing on Mir. Over the next few days, additional burns will gradually bring Discovery to within eight nautical miles behind Mir. At this point, the Ti burn is fired and the final phase of the rendezvous begins. Discovery will close the final 8 nautical miles to Mir during the next one-and-a-half-hour orbit. At this point, the Shuttle's rendezvous radar system begins providing range and closing rate information to the crew.

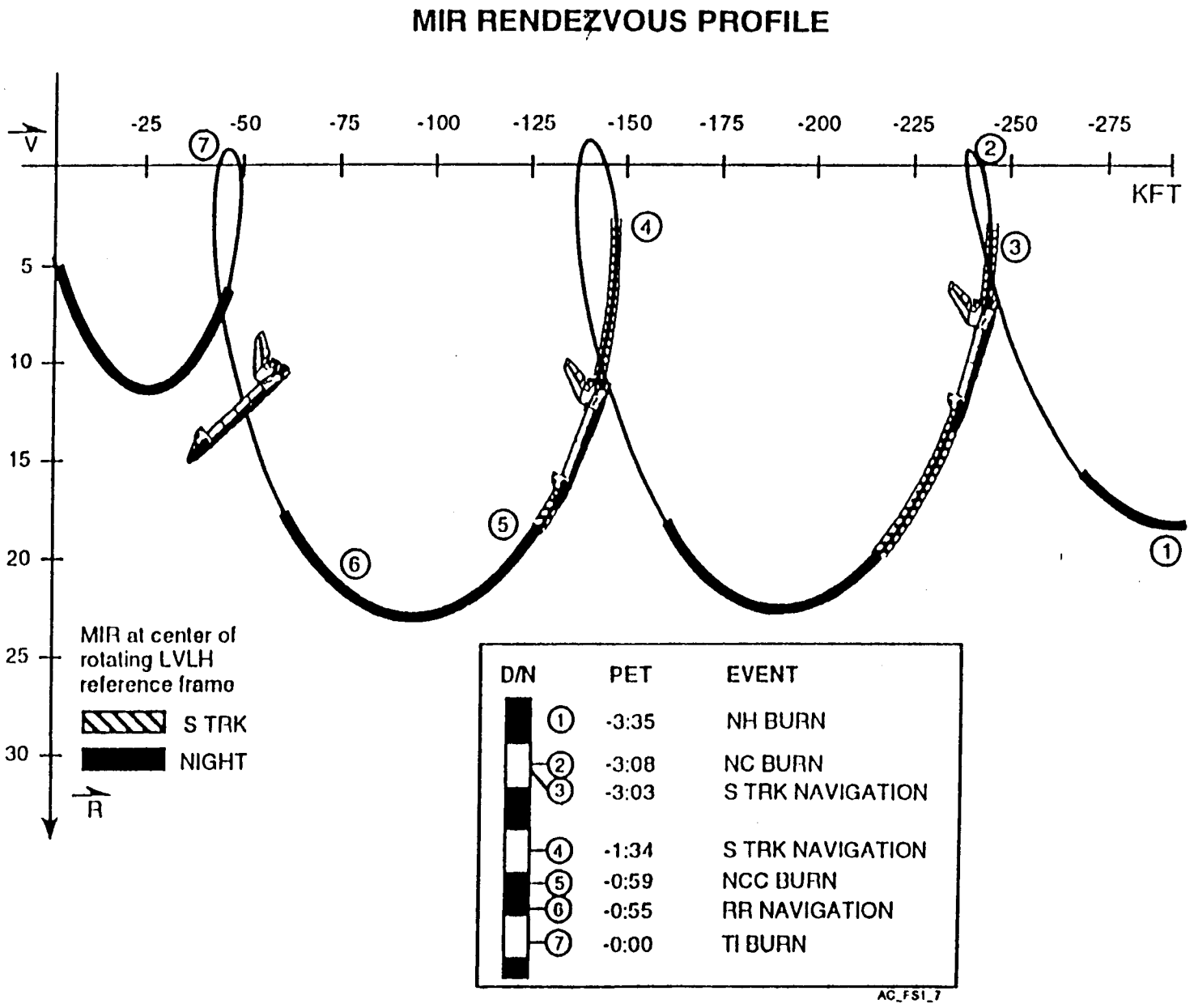
The manual phase of the operation begins just after Discovery passes about a half-mile below Mir when Commander Jim Wetherbee takes the controls at a distance of about 2,000 feet. Wetherbee will be flying the Shuttle from the aft flight deck controls as Discovery circles up to intersect the velocity vector of Mir. The velocity vector, also known as the V-Bar, is an imaginary line drawn along Mir's direction of travel.

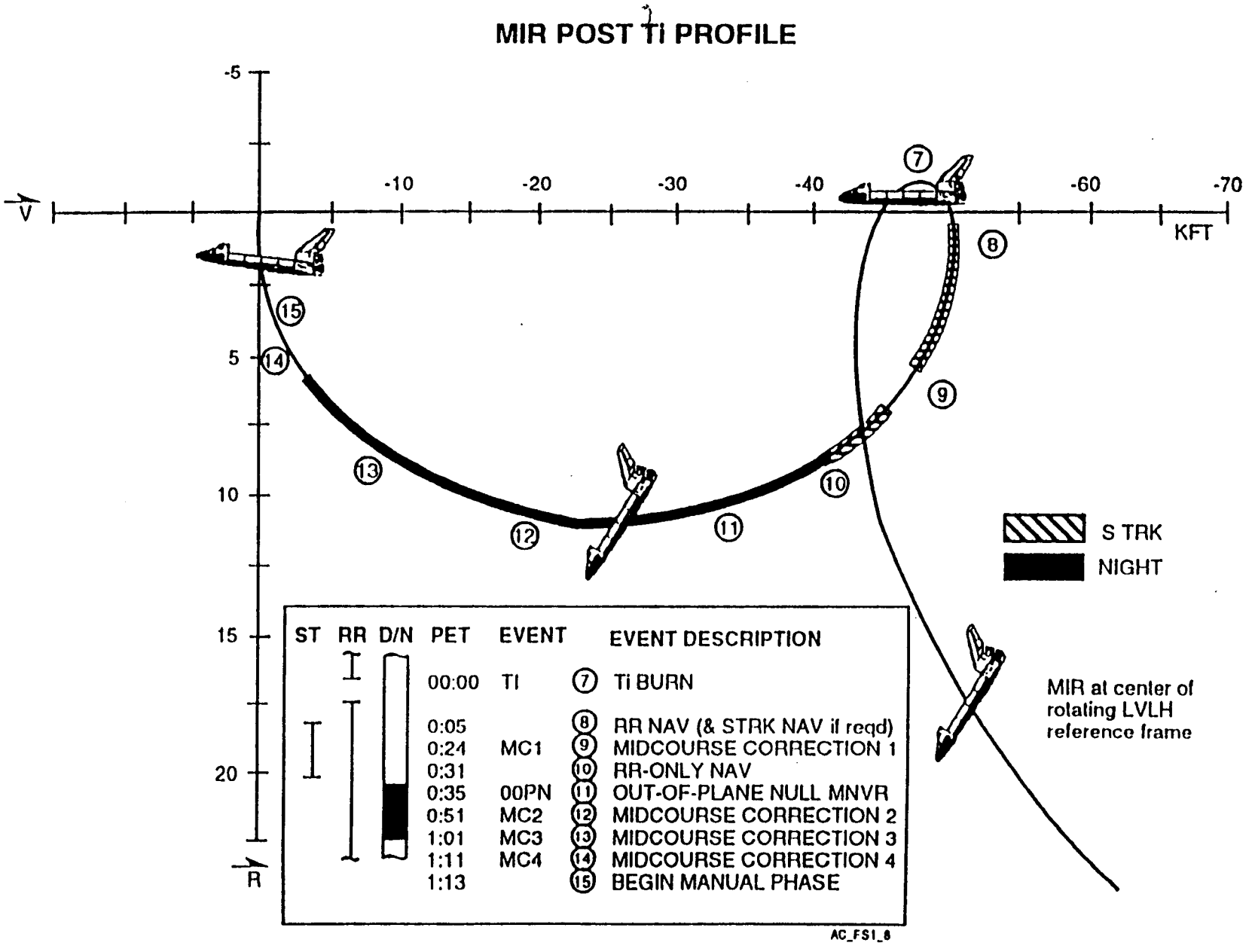
Wetherbee will stop Discovery's approach when the Shuttle reaches a point about 400 feet directly in front of Mir.

After the Shuttle moves to within 1,000 feet of Mir, Discovery's steering jets will be fired in a mode called "Low Z". This approach uses braking jets that are slightly offset to the Mir rather than steering jets pointed directly at the Station, thus avoiding contaminating or damaging the Station. Also, as Discovery reaches close proximity to Mir, the Trajectory Control Sensor, a laser ranging device mounted in the payload bay, will supplement the navigation information by supplying data on the Shuttle's range and closing rate to Mir.

Discovery will maintain its position 400 feet in front of Mir until Flight Control teams in Russia give a "go" for the Shuttle's approach. Wetherbee will then slowly fly the Orbiter from 400 feet to a point about 30 feet from Mir, aligning with the Station's docking module in a rehearsal of a docking approach planned for Shuttle mission STS-71. To assist with the alignment, Wetherbee will watch the approach from a centerline television camera, mounted in the upper window of the Spacehab module, on a monitor in the aft flight deck. When within about 200 feet of Mir, Discovery will begin air-to-air communications with cosmonauts on Mir using a VHF radio system.

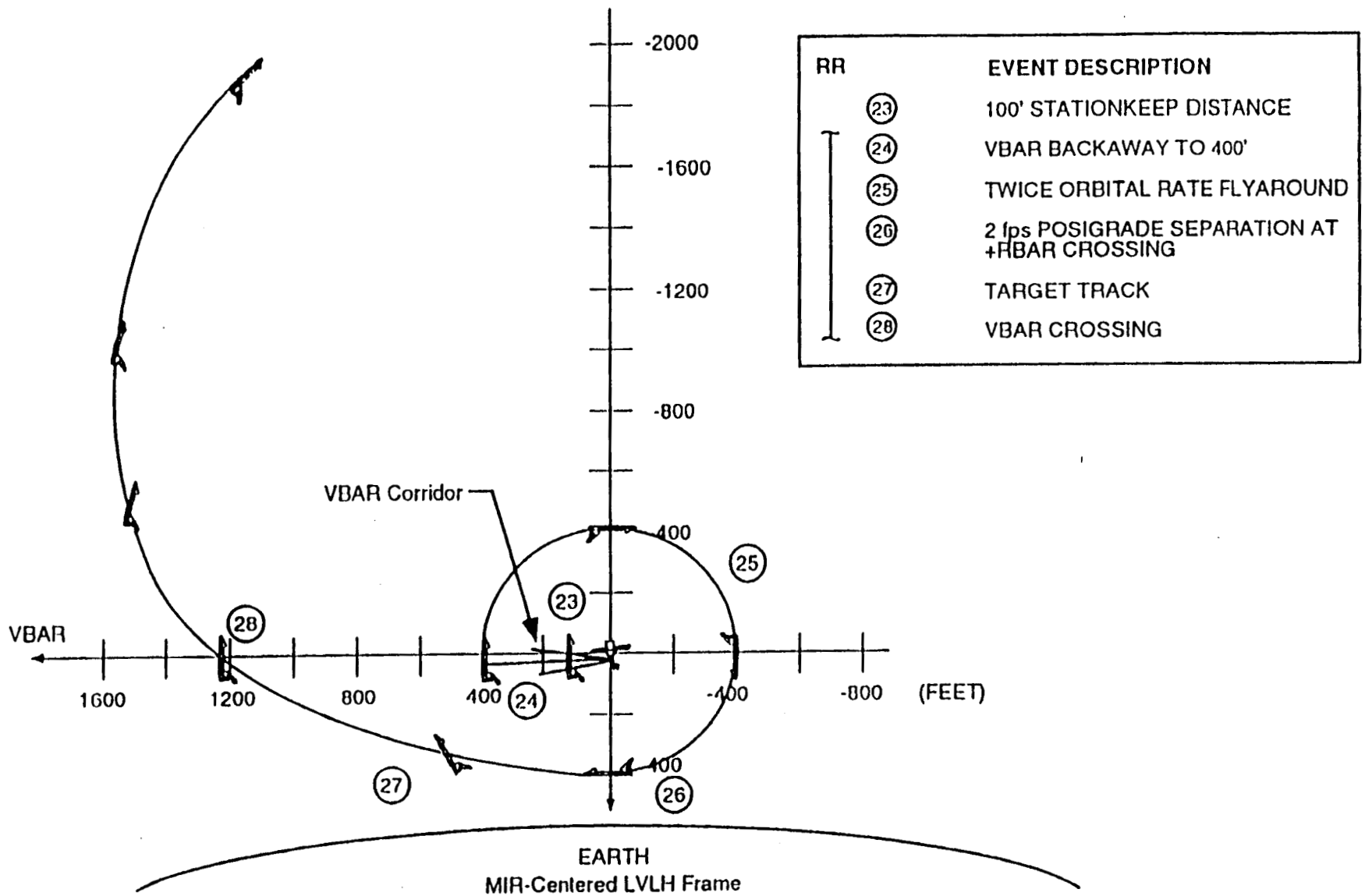
At 30 feet from the docking port, Wetherbee will again stationkeep, rehearsing a maneuver to orient Discovery properly to the docking port, before slowly backing the Orbiter away from Mir.


MIR RENDEZVOUS PROFILE
V
-25
-50
-75
-100
-125
-150
-175
-200
-225
-250
-275
KFT
5
10
15
20
25
30
R
MIR at center of rotating LVLH reference frame
S TRK
NIGHT
D/N
PET
EVENT
1 -3:35 NH BURN
2 -3:08 NC BURN
3 -3:03 S TRK NAVIGATION
4 -1:34 S TRK NAVIGATION
5 -0:59 NCC BURN
6 -0:55 RR NAVIGATION
7 -0:00 TI BURN
AC_FS1_7


MIR POST Ti PROFILE
-5
-10
-20
-30
-40
-60
-70
V
KFT
5
10
15
20
R
S TRK
NIGHT
MIR at center of rotating LVLH reference frame
ST RR D/N PET EVENT EVENT DESCRIPTION
00:00 TI ⑦ Ti BURN
0:05 ⑧ RR NAV (& STRK NAV if reqd)
0:24 MC1 ⑨ MIDCOURSE CORRECTION 1
0:31 ⑩ RR-ONLY NAV
0:35 00PN ⑪ OUT-OF-PLANE NULL MNVR
0:51 MC2 ⑫ MIDCOURSE CORRECTION 2
1:01 MC3 ⑬ MIDCOURSE CORRECTION 3
1:11 MC4 ⑭ MIDCOURSE CORRECTION 4
1:13 ⑮ BEGIN MANUAL PHASE
AC_FS1_8

MIR FLY-BY

MIR BACKAWAY, FLYAROUND, AND SEPARATION



When Discovery is again about 400 feet from Mir, Wetherbee will begin a slow fly-around, maintaining a distance of about 450 feet from Mir. Discovery will completely circle Mir once over the next 45 minutes.

The two spacecraft will begin the separation sequence when Discovery reaches a point about 450 feet above Mir for the second time. The Orbiter will then fire its steering jets in a maneuver that will put it on a course to eventually take it ahead of Mir as Discovery opens the distance between the two spacecraft with each orbit. Throughout the operation, Discovery's crew will use video and still cameras to document the exterior of the Mir.

The rendezvous will validate a number of flight techniques that will be employed on subsequent docking missions. These techniques include the use of precision flying as the Shuttle closes in on Mir, validating the use of a centerline camera for targeting the docking mechanism on Mir, verifying the absence of plume effects, demonstrating VHF radio communications, inspecting the Mir complex through photographs and video, and demonstrating the joint operations between Mission Control Centers in Houston, and Kaliningrad, Russia.

While the fly-around will provide valuable information for flight designers planning the docking missions, the completion of these objectives is not mandatory in preparation for the STS-71 mission.

SPARTAN 204

Background

The Spartan program is designed to provide easy and relatively inexpensive access to Earth orbit via the Space Shuttle for science experiments. Spartan's design consists of a basic carrier, which, with the addition of a science experiment, becomes a complete spacecraft designed to meet specific science objectives on each mission. Spartan missions include stellar, solar, Earth fine-pointing, and microgravity science and technology experiments requiring space environments away from the Space Shuttle.

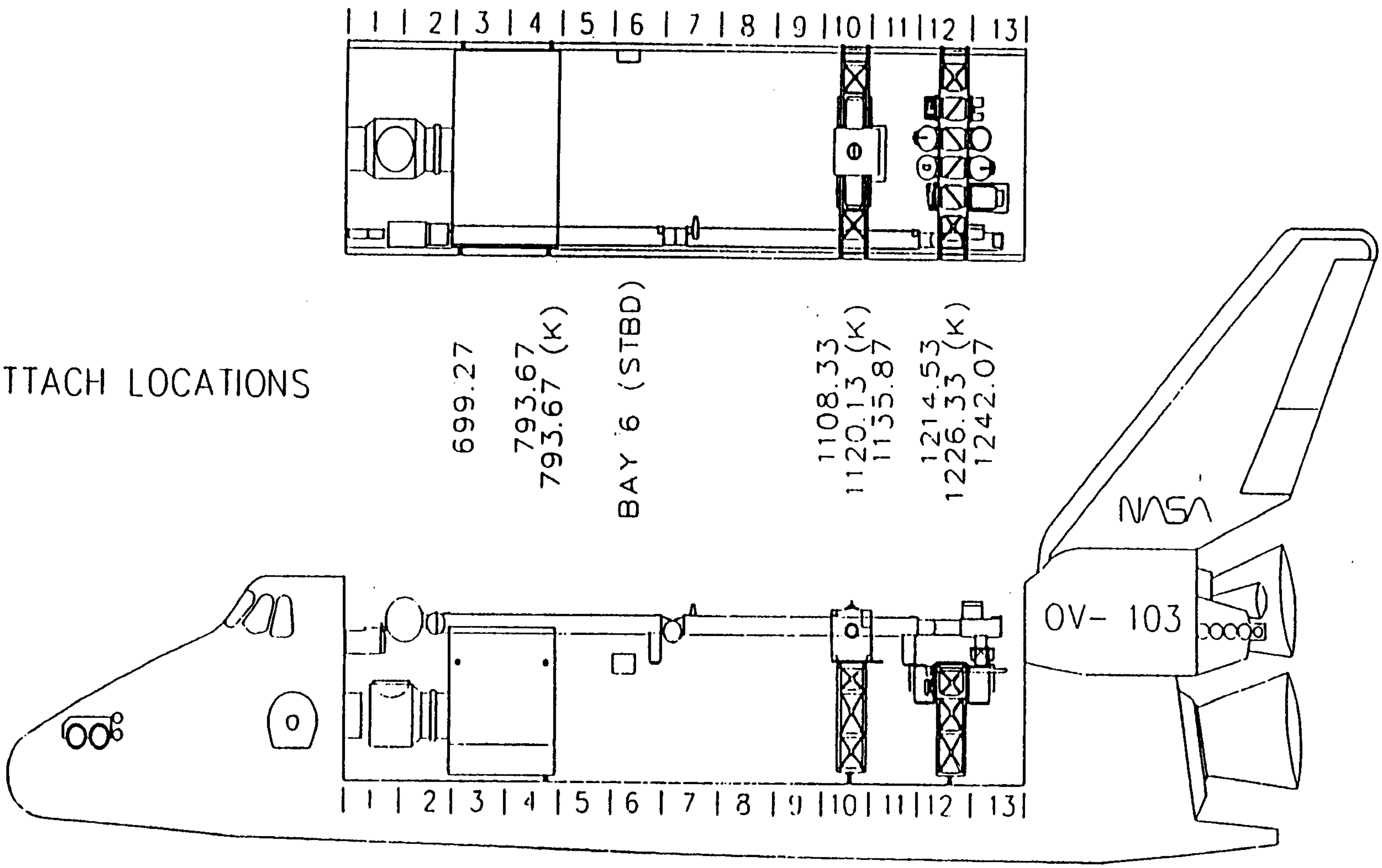
The Spartan program was conceived in the mid-1970s and developed by the Special Payloads Division, Goddard Space Flight Center (GSFC), Greenbelt, MD, and the U.S. Naval Research Laboratory, Washington, DC, to extend the capabilities of sounding rocket-class science experiments by making use of the Space Shuttle.

In June 1985, a Spartan mission successfully carried an X-ray telescope aboard STS-51G. Another carrier, Spartan Halley, was on board Shuttle Mission

STS-51L. In April 1993 and September 1994, Spartan 201 was flown aboard the Space Shuttle Discovery on missions STS-56 and STS-64. This is the first flight of the Spartan 204 carrier system.

STS-63 PAYLOAD CONFIGURATION

ATTACH LOCATIONS



PAYLOADS

SPHAB-3

DTO 700-5

SPARTAN 204

CGP/ODERACS-2

Spartan 204 Mission

Spartan 204 will obtain data in the far ultraviolet region of the spectrum from diffuse sources of light. For this mission, the Spartan 204 spacecraft is designed to operate both while attached to the Shuttle's Remote Manipulator System (RMS) or robot arm, and in free-flight away from the Orbiter.

Spartan 204's mission will occur in two distinct phases. The first phase will be on flight day 2, when the crew will grapple the Spartan spacecraft with the robot arm and unberth it from its support structure. The crew then will conduct scientific observations for about 4.5 hours by pointing Spartan at the Shuttle's tail to observe surface glow. It also will point at a primary Reaction Control System thruster to obtain far ultraviolet spectrographs of a thruster firing. After these operations Spartan will be reberthed in the Orbiter bay as other Shuttle operations take place.

The second phase of Spartan 204 operations will begin on Flight Day 5, when the free-flight operations begin. The crew will prepare Spartan by again grappling it with the robot arm and unberthing it from its support structure. Spartan then will be released from the robot arm, and the Orbiter will back away from the Spartan free-flyer spacecraft.

Spartan will operate autonomously in free-flight for a mission duration of approximately 43.5 hours following a pre-programmed science mission, providing its own battery power, pointing system and recorder for capturing data. The scientific observations will be recorded on film on board Spartan 204, and analyzed by scientists and engineers after it is returned from space.

After its free-flyer mission ends on Flight Day 7, the Orbiter will fly back to the Spartan 204 spacecraft, retrieve it with the robot arm, and power it off. The Spartan spacecraft will be reberthed in the Orbiter bay, completing its scientific mission.

SPARTAN 204 SCIENCE

The Far Ultraviolet Imaging Spectrograph (FUVIS) experiment objectives are to study astronomical and artificially-induced sources of diffuse far-ultraviolet radiation. The astronomical diffuse sources include nebulae, celestial diffuse background radiation and nearby external galaxies. The artificial sources include emissions associated with the Orbiter -- the recently discovered Shuttle surface glow and emissions due to Shuttle Reaction Control system rocket engines.

The FUVIS astrophysical science objectives are primarily concerned with improving scientific understanding of the composition, physical and chemical properties, and distribution in space of the interstellar medium.

The interstellar medium is the gas and dust which fills the space between the stars, and which is the material from which new stars and planets are formed.

The Orion Nebula is an example of a cloud of interstellar material which is excited to glow by the far-ultraviolet light emitted by the very hot stars embedded within it. The Cygnus Loop is an example of a supernova remnant - a shell of interstellar gas which is excited to glow by the outwardly-moving shock wave produced by a stellar explosion -- a supernova -- which occurred about 50,000 years ago.

The unique features of FUVIS are that it observes in the far-ultraviolet region of the electromagnetic spectrum, which can provide new information unobtainable in other spectral regions, and it is optimized for the study of diffuse sources rather than point sources (e.g., stars). However, since FUVIS is an imaging spectrograph, it also can obtain spectra of stars for in-flight calibration, and can separate out the contributions of stars from those of truly diffuse sources.

The FUVIS instrument is designed to provide the highest possible diffuse source sensitivity in the far-ultraviolet, but also provides efficient means for study of large, faint galactic nebulae such as the Barnard Loop, North America, and Cygnus Loop nebulae, comets, and diffuse emissions associated with the Shuttle. It also is capable of mapping nearby galaxies such as the Magellanic Clouds and the Andromeda Galaxy.

Detailed FUVIS plans include observations of stellar UV radiation which is scattered by interstellar dust particles to obtain information on the physical properties, composition, and spatial distribution of the dust; and of emission lines from the gaseous phases of the interstellar medium; i.e., diffuse nebulae and the general interstellar medium, which provides information on gas temperature, composition, and spatial distribution.

Department of Defense objectives include studies to determine the UV spectral intensity distributions in, and chemical species contributing to the emission from, Shuttle glow and rocket engine plumes.

Spartan 204 science objectives are sponsored by the U.S. Naval Research Laboratory (NRL), Washington, DC. The FUVIS science investigation team consists of Principal Investigator Dr. George Carruthers of NRL, and Co-Investigators Dr. Adolf Witt, University of Toledo, Dr. Reginald Dufour, Rice University, and Dr. John Raymond, Center for Astrophysics.

SPARTAN OPERATIONS

Attached Operations

The science payload is mounted aboard the Spartan carrier. When the Shuttle is on orbit and the payload bay doors are open, a crew member uses the robot arm to lift Spartan from the payload bay. The instrument on the Spartan carrier is controlled over a command path through the robot arm while a crew member points the spacecraft on the end of the arm using the robot arm's controls. Several pointing sequences will be performed over one and a half orbits. After this part of the science mission is over, tracking control system tests will be performed using the spacecraft on the end of the robot arm before the spacecraft is berthed.

Free-flight Deployment

After the Mir rendezvous portion of the mission is complete, a crew member will again use the robot arm to lift the Spartan spacecraft from the payload bay, and this time will release it over the side of the Shuttle. It will be deployed from the Shuttle so that it can operate independently and leave the Orbiter free for other activities. Because the Spartan and Shuttle become separated, the Spartan will be able to view the celestial targets clear of any contamination which might be generated by Shuttle thruster firings.

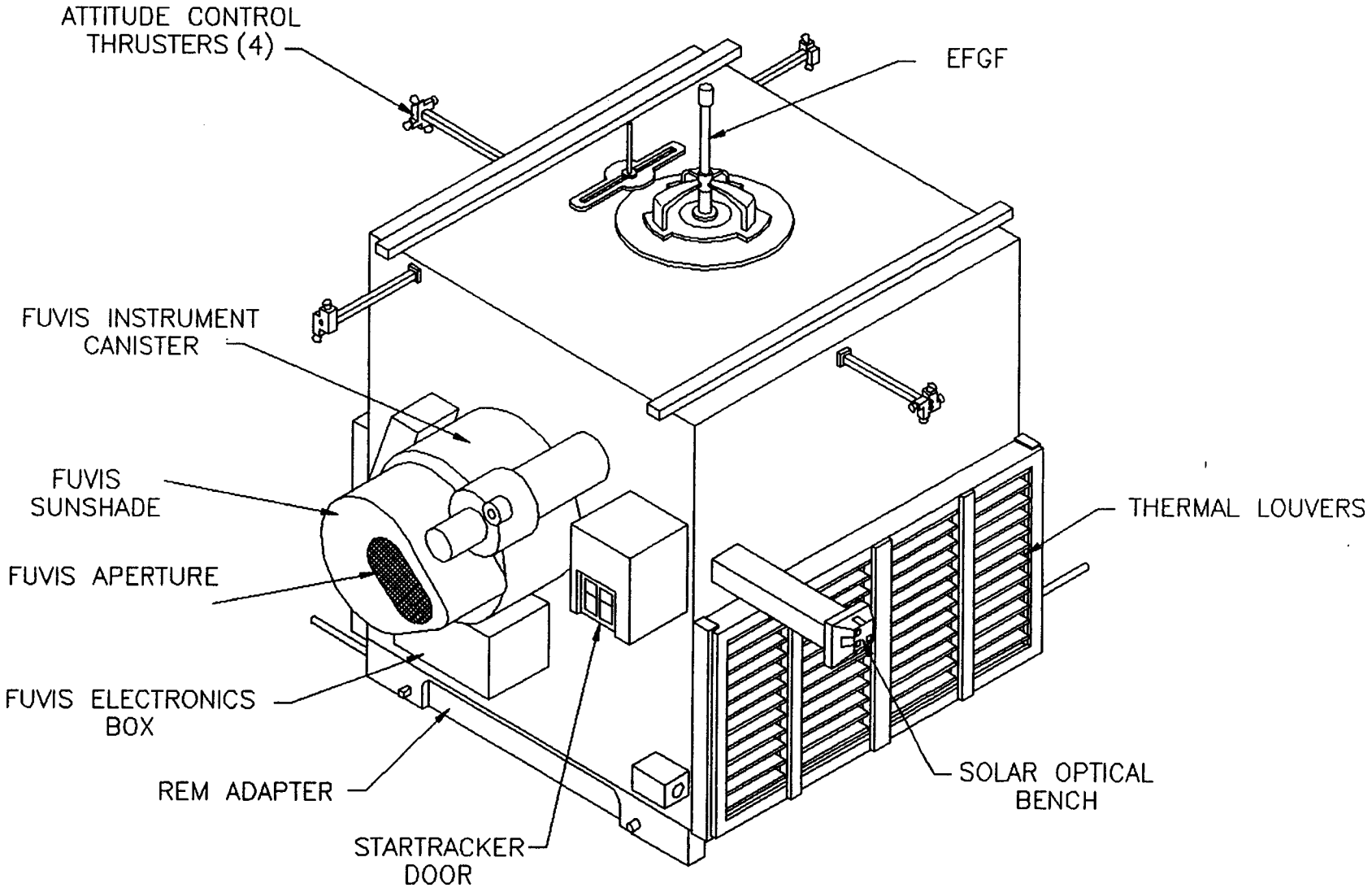
After initialization, Spartan is designed to operate autonomously. During the free-flight, the Shuttle crew has no interaction with the satellite other than deploying and retrieving it.

For approximately 40 hours, Spartan 204's instrument will observe various celestial targets of interest as the Space Shuttle paces it from behind. About four hours prior to the scheduled retrieval, the Shuttle will perform engine firings allowing it to close on Spartan 204, eventually passing directly below it before a crew member manually flies the final few hundred feet (approximately 100 meters) to allow the satellite to be grasped by the robot arm. Once caught by the arm, Spartan 204 will be brought back into the cargo bay.

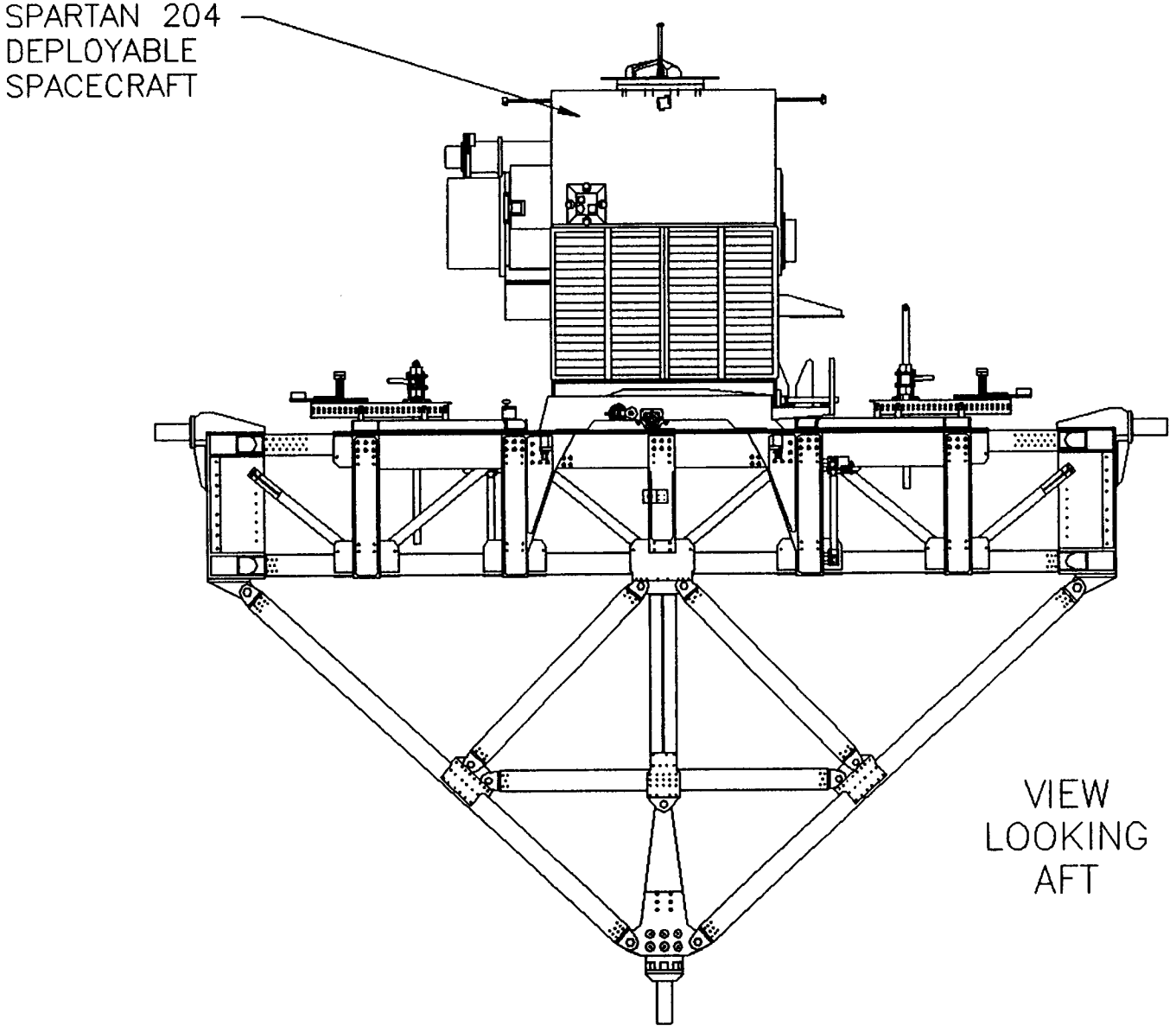
Detailed Test Objectives (DTOs)

Besides its scientific mission, the Spartan 204 spacecraft will support two Space Station Detailed Test Objectives, or DTOs. For the first DTO, Spartan 204 has six laser retroreflectors mounted on it to aid in testing the Tracking Control System (TCS). They will be used during proximity operations after the attached operations on Flight Day 2, as well as during deployment and retrieval on flight days 5 and 7.

For the second DTO, the Spartan 204 spacecraft will be used as a large mass handling object by the EVA crew members. They will demonstrate the ability to move large objects without the robot arm, using new equipment and techniques.



SPARTAN 204 SPACECRAFT


SPARTAN 204
DEPLOYABLE
SPACECRAFT
VIEW
LOOKING
AFT

During their EVA, the astronauts will practice moving Spartan 204 around the payload bay after its science mission is complete, on Flight Day 7. The Spartan 204 spacecraft has mounted on it three EVA handling attachment points to aid the crew in controlling the spacecraft. After the mass-handling portion of the EVA, the astronauts will put the Spartan spacecraft back onto its support structure for the remainder of the mission.

SPARTAN 204 STATISTICS

Launch Vehicle:	Space Shuttle Discovery (STS-63)
Deployment Altitude:	Approximately 190 nautical miles
Inclination:	51.6 degrees
Spacecraft Weight:	2,661 lbs (1,210 kg)

SPARTAN 204 MANAGEMENT

The Spartan-204 mission is sponsored by the Air Force Space Test Program. The FUVIS is the primary scientific instrument on the Spartan-204. The FUVIS experiment is sponsored, designed and constructed at the Naval Research Laboratory, Washington, DC.

The Spartan project is managed by GSFC for the Office of Space Science, Washington, DC. The acting Spartan Project Manager is Dave Shrewsberry, and the Goddard Space Flight Center Mission Manager is Mark Steiner. GSFC provides the Spartan carrier and manages its integration with the Shuttle.

STS-63 HITCHHIKER PROGRAM/PAYLOAD OVERVIEW

The Hitchhiker Program, managed by the Shuttle Small Payloads Project at GSFC, is designed for customers who wish to fly quick-reaction and low-cost experiments on the Shuttle. The program's system is designed to be modular and expandable in accordance with customer requirements. The system provides power, data or command services to operate these experiments. Typically, payloads receive their power and data handling through the Hitchhiker Avionics which provides standardized electrical, telemetry, and command interfaces between the Orbiter and the experiments. During the mission operations, experimenters will receive real-time communications between themselves and their payloads at the Payload Operations Control Center (POCC) located at GSFC.

The first of four Hitchhiker missions manifested for 1995 is CGP/ODERACS-II. The payload's acronym stems from the following experiments: Cryo System Experiment (CSE), Shuttle Glow (GLO-2) experiment and the Orbital Debris Radar Calibration System-II (ODERACS-II) experiment. An IMAX Camera also is flying in this configuration. The Hitchhiker carrier used to support the CGP/ODERACS-II experiments is a crossbay carrier referred to as a Mission Peculiar Equipment Support Structure (MPESS). Displays of orbit position, attitude, ancillary data, and any downlink data will allow the experimenters to monitor the status of their payloads during the mission.

Experiment: Cryo System Experiment (CSE)
Customer: Jet Propulsion Laboratory (JPL) and Hughes Aircraft Corporation
Principal Investigator: Russell Sugimura (JPL), Sam Russo (Hughes)
Mission Manager: Susan Olden, Hitchhiker Program, GSFC

The Cryo System Experiment (CSE) is a space flight experiment conducted by the Hughes Aircraft Co., in a cooperative program with NASA. The overall goal of the CSE is to validate and characterize the on-orbit performance of two thermal management technologies that comprise a hybrid cryogenic system. These thermal management technologies consist of: 1) a new generation, long life, low vibration, 65 K Stirling-cycle cryocooler, and 2) an oxygen diode heat pipe that thermally couples the cryocooler and a cryogenic thermal energy storage device. The experiment is necessary to provide a high confidence zero-gravity database for the design of future cryogenic systems for NASA and military space flight applications.

These technologies promise to satisfy many of the currently defined system performance goals for planned NASA and military space programs. Feasibility of each technology has already been demonstrated in independent R&D ground based laboratory tests. However, questions raised by the scientific community relative to the performance of these components in a zero-gravity environment must be answered before these technologies can be optimized for application to flight systems. The CSE flight experiment is configured to: 1) provide data necessary to resolve performance and design issues, 2) validate capability of the hybrid cooling system to meet future mission requirements, and 3) provide for the high confidence and the design of flight system concepts currently being considered.

During on-orbit operation, test data will be recorded to characterize performance of the technology including 1) oxygen diode heat pipe temperature gradient and transport capacity in steady-state and transient conditions, 2) system vibration levels attributed to the active cryocooler, and 3) integrated, extended operations of the cooling system.

An understanding of the performance of these components in flight is required to develop accurate performance models for designing flight hardware. Key issues to be addressed include: 1) heat pipe transfer capacity and start up behavior, 2) cryocooler mechanical disturbance and cryocooler dynamic balance.

Ground-based life testing of the cryocooler has been initiated at Hughes in support of the experiment and will continue into next year for comparison with flight data.

The flight experiment results will be significant to a number of satellites scheduled for deployment in the late 1990s, for which cryocooler technologies are contemplated, including those in support of NASA's Mission to Planet Earth and Astrophysics Programs.

The Cryo System Experiment illustrates an important type of NASA in-space flight experiment in which a relatively mature system technology is validated to provide the option for subsequent application for future space system development. A successful experiment could be followed by the use of the technology in an operational system.

Experiment: Shuttle Glow Experiment (GLO-2)
Customer: University of Arizona and USAF/Phillips Laboratory
Principal Investigator: Dr. Lyle Broadfoot (Univ. of AZ), Dr. Edmond Murad (Phillips Lab)
Mission Manager: Susan Olden, Hitchhiker Program, GSFC

This experiment originated as the "Shuttle Glow" experiment sponsored by the USAF/Phillips Laboratory. The nature of the instrument makes it ideal for studies of Earth's thermosphere. Consequently, it has become a joint program with NASA/Space Physics Division of the Office of Space Science.

The GLO-2 will investigate the mysterious shroud of luminosity, called the "glow phenomenon," observed by astronauts on past Shuttle missions. Theory suggests that the glow may be due to atmospheric gases collisionally interacting on the windward or ram side surface of the Shuttle with gaseous engine effluents and contaminant outgassing molecules.

To understand why spacecraft glow, and the potential effects of glow on space-based sensors, USAF Phillips Laboratory is sponsoring the experiment to collect spectral and imaging data to characterize the optical emissions. The principal investigators, Dr. Edmond Murad from the Phillips Laboratory and Dr. Lyle Broadfoot from the University of Arizona, plan to collect high resolution (0.5 nanometer) spectra over a wide spectral range including the ultraviolet and visible portions of the spectrum. The spatial extent of the glow will be mapped precisely (0.1 degrees), and the effects of ambient magnetic field, orbit altitude, mission elapsed time, Shuttle thruster firings, and surface composition on the intensity and spectrum of the glow will be measured. An optical emission model will then be developed from the data.

The GLO-2 experiment consists of imagers and spectrographs, which are bore-slighted to the imagers, so that both sensors are focused onto the same

area of observation, for example, the Shuttle tail. The imagers serve to unambiguously identify the source region of the glow spectrum as well as to map the spatial extent of the luminosity. Unique features of the sensors are their high spectral and spatial resolution. Each spectrograph employs a concave holographic grating that focuses and disperses light within a small field of view (0.1 by 2.0 degrees) over the wavelength range of 115-1100 nanometers. The sensor comprises nine separate channels, each of which operates simultaneously and independently, to cover individual segments of the spectrum. Spectrally resolved light from the grating is amplified by image intensifiers that are optically coupled to a charge-coupled-device (CCD) detector. CCD-pixel readouts are summed in groups to achieve spatial mapping with a resolution of about 0.1 degrees.

The imager comprises six separate telescopes, of which four are intensified. Images are conducted to the single CCD by fiberoptics. One image channel is wide angle, and one has high magnification. The other four channels are filtered to different wavelength bands. The spectrographs and imagers are mounted on a scan platform, which rotates about the vertical and horizontal axes, and provides sensor scanning in azimuth and elevation over glowing Shuttle surfaces. Experiment hardware units include the sensor head, a scan platform, electronics, and high- and low-voltage power supplies.

The Shuttle glow experiments are short in duration compared to the total flight time of the mission, therefore, the remainder of the flight is dedicated to studies of Earth's atmosphere. This phase of the experiment is called the Arizona Airglow Experiment. The scientific objectives are related to the ionosphere, thermosphere and mesosphere section of the NASA Space Physics Division. A scientific team will receive the data, assist in planning the experiments, and coordinate the overflights with ground-based sites or networks. The period of the flight is identified in the scientific community as a campaign. Active participants who have ground-based instrumentation will attempt to make observations throughout the campaign. The data are correlated and deposited in a data bank at the National Center for Atmospheric Research, Boulder, CO, for use by the community. The coordination of this data is important to relate local observation to the global picture provided by the GLO observations from the Shuttle.

An accurate description of the process leading to the emissions from the sunlit thermosphere is being pursued by the GLO experiment. The two prominent ion emissions are the [OII] (7320Å) and the N2+ (1N) systems. Presently, both emissions have shortcomings as reliable signatures of the ionosphere conditions. The nature of the nitrogen ion N2+ (1N) emission in the twilight and dayglow has still not been fully explained. The intensity of the emission is greater, by about a factor of two, than models predict. The nature of the emission is further confused since neither the extended rotational nor vibrational distributions are understood. Earlier data sets have not had the quality to resolve these problems. Investigators believe that the GLO data will provide more insight.

The nature of the mesospheric reactions in the night atmosphere have eluded proper investigation. The ability of the GLO experiment to observe all of the night sky emission simultaneously has already demonstrated its usefulness. The GLO observation from a previous mission demonstrated that vertical profiles through the emitting layer are easily obtained and will add markedly to understanding of these mesospheric processes.

An important task for the GLO experiment is concerned with atmospheric model validation. Atmospheric models typically predict vertical profiles of reaction products which give rise to emissions. The models do not account for the manifold of energy distribution within systems but, rather, predict the total product in excited states. Establishing the relationship of the total production to the observation is the responsibility of the experiment and the spectral analyst. The relationship of the model to the observation is the responsibility of the theorist. Again, collaboration is the most powerful tool; each party contributes its expertise to a single problem.

A graduate student program will provide the interface between the model and the experiment. The modeler will be involved in the planning to optimize his/her validation. The observation will be advocated by the graduate student and the data product will be prepared and defended by the graduate student using the spectral analysis capabilities at the GLO data center at the University of Arizona.

In the next few years the GLO experimenters, USAF/Phillips Lab and the University of Arizona representatives, will be changing research practices because the overall objective is to understand the nature of our atmosphere on a global basis. Global models are already well underway, but the hope of verifying those models on a global scale is unrealistic. Our nearest approach to the global verification will come through coordinated observational opportunities. No one type of experiment, orbit or ground-based observation is a sufficient test. Our closest approach will be through coordinated studies, ground stations, rocket and satellite coordination.

Experiment: IMAX Cargo Bay Camera (ICBC)
Customer: Johnson Space Center
Payload Manger: Dick Walter
Mission Manager: Susan Olden, Hitchhiker Program, GSFC

The IMAX Cargo Bay Camera is a space-qualified, 65 mm color motion picture camera system that consists of a camera, lens assembly, and a film supply magazine containing approximately 3500 feet of film and an empty take-up magazine. The camera is housed in an insulated, pressurized enclosure with a movable lens window cover. The optical center line of the 60 mm camera lens is fixed and points directly out of the payload bay along the Orbiter Z axis with a 15 degree rotation towards the Orbiter nose. Heaters and thermal blankets provide proper thermal conditioning for the camera electronics, camera window, and film magazines.

The 65 mm photography will be transferred to 70 mm motion picture film for playing in IMAX theaters. An audio tape recorder with microphones will be used in the crew compartment to record middeck audio sounds and crew comments during camera operations. The audio sound is then transferred to audio tapes or compact discs for playing in coordination with the IMAX motion picture.

The camera system is operated by the crew from the Aft Flight Deck with the enhanced Get Away Special Autonomous Payload Controller (GAPC). Commands such as on/off, camera standby, and camera run/stop may be initiated by the crew. Additional commands for camera setups such as f/stop, focus, and frame rate status of exposed film footage also are accomplished by the crew using the GAPC. A light level measurement unit will be used by the crew to set the lens aperture. Four focus zones and seven aperture settings are available for this flight.

The normal camera speed is 24 frames per second (fps). On this flight, this also can be changed to 3 fps for photographing slower moving objects. The 3500 feet of film in the ICBC will last approximately 10.5 minutes at 24 fps and much longer at 3 fps. Film cannot be changed in flight and ICBC operations are terminated when all film is exposed. ICBC is managed by Dick Walter of the Johnson Space Center.

Experiment: Orbital Debris Radar Calibration System-II (ODERACS-II)
Customer: Johnson Space Center
Principal Investigator: Gene Stansbery
Mission Manager: Susan Olden, Hitchhiker Program, GSFC

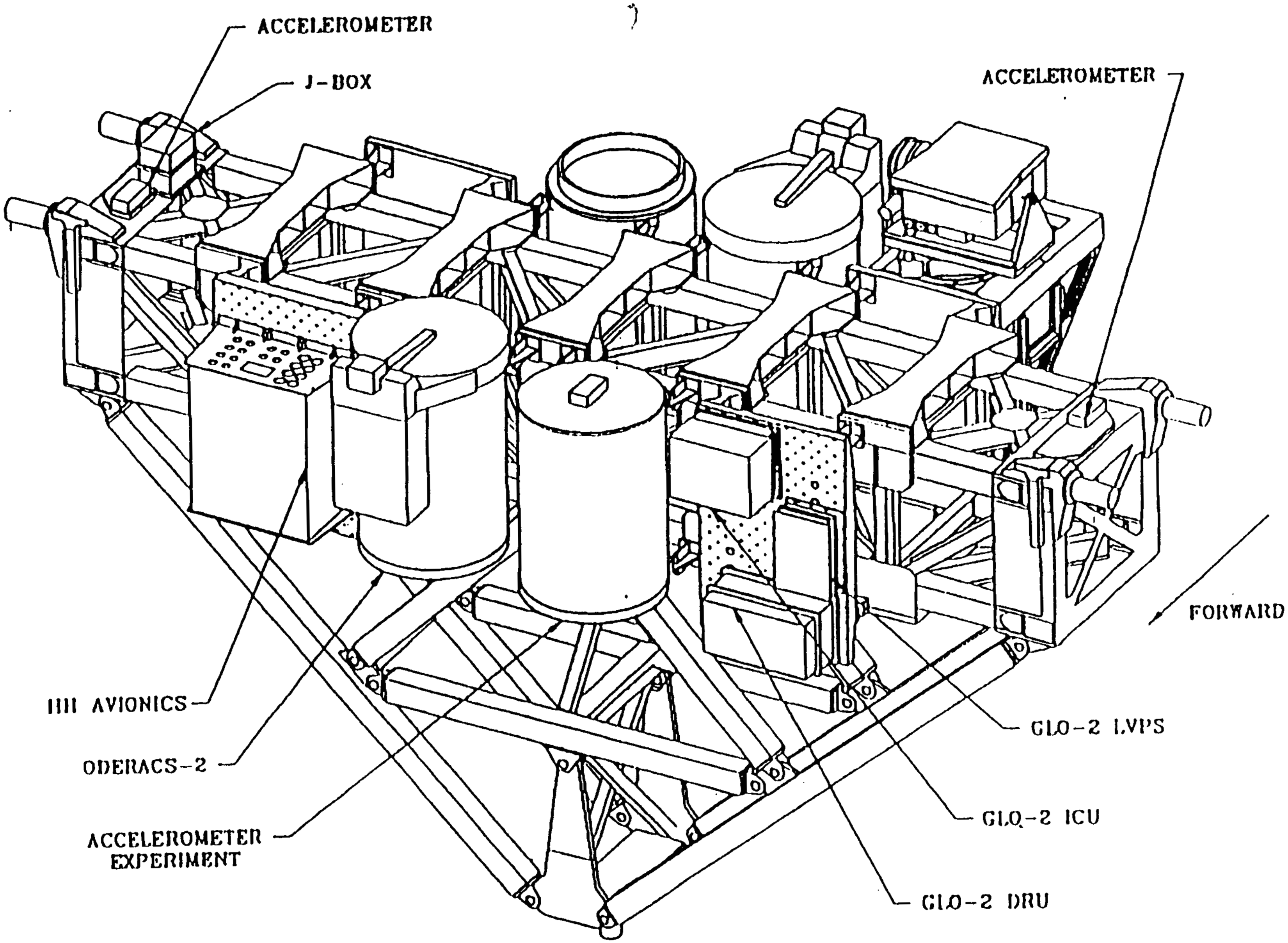
Man-made debris, now circulating in a multitude of orbits about the Earth as a result of the exploration and use of space, poses a growing hazard to future space operations. Since the launch of Sputnik 1, more than 3200 launches have placed about 6500 artificial orbiting objects, weighing 2 million kilograms (4.4 million pounds) in orbit around the Earth. While these objects are cataloged by the Space Surveillance Network operated by United States Command (USSPACECOM), only six percent represent functional satellites; the rest are considered debris. Additionally, USSPACECOM tracks only objects larger than 10 cm in diameter. However, history has proven that smaller objects cause considerable damage to spacecraft. Hence, orbital debris is a critical factor in the shielding design and mission planning of the International Space Station.

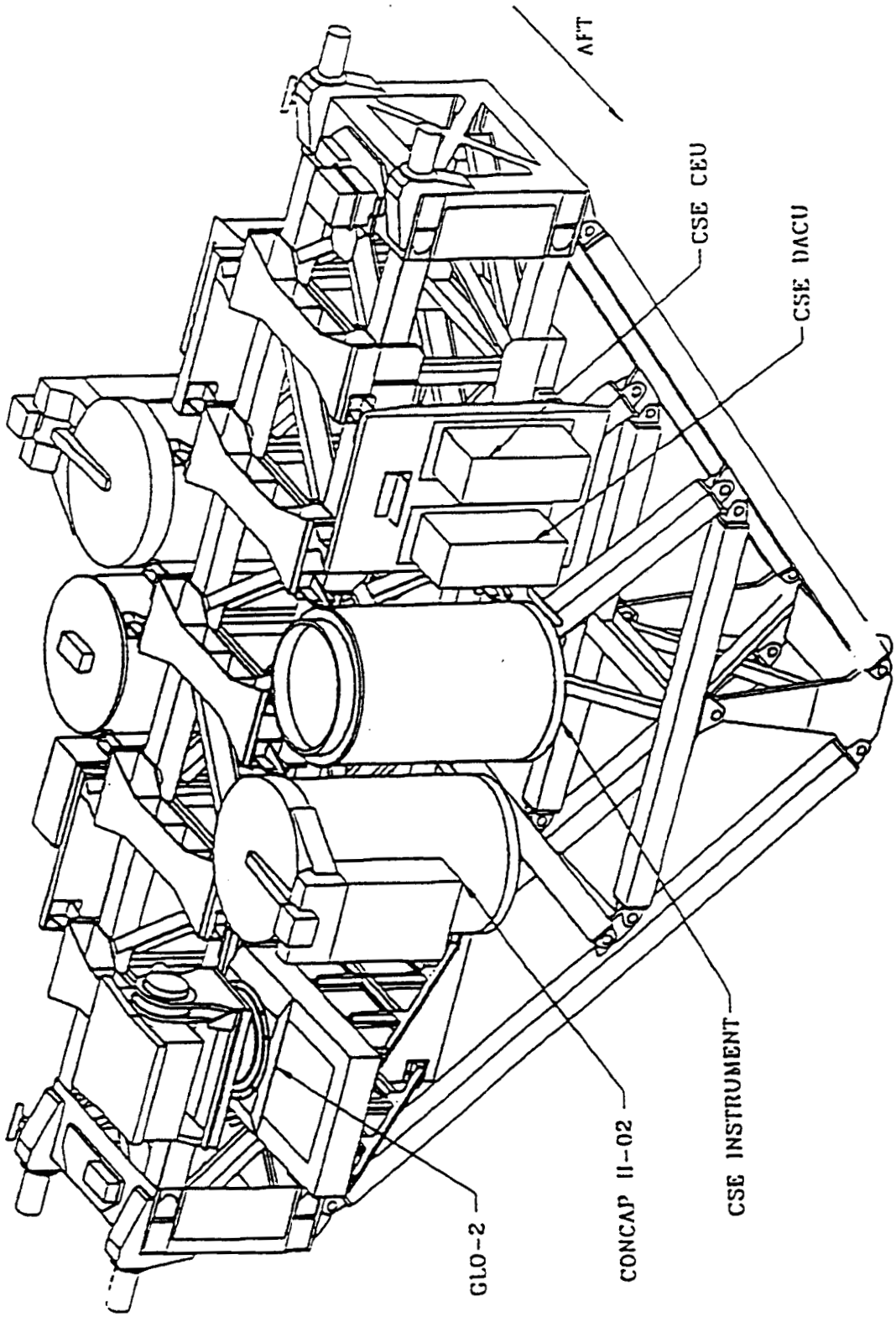
For the past decade, the Johnson Space Center has led efforts, such as using the Haystack Radar, to characterize the debris environment for sizes smaller than 10 cm. The Orbital Debris Radar Calibration System (ODERACS) provides a vehicle whereby small calibration targets are placed in Low Earth Orbit (LEO) for the purpose of calibrating ground-based radar and optical systems so that they may more accurately provide information regarding small debris in LEO.

Radar facilities include: the Millstone, Haystack, and the Haystack Auxiliary Radars in Massachusetts; the Kwajalein Radars (TRADEX, ALCOR, Millimeter Wave, and ALTAIR) in the South Pacific; the Eglin Radar in Florida; the PARCS Radar in North Dakota; and the FGAN Radar in Germany. Optical facilities include: the worldwide GEODDS telescope network, the NASA/JSC telescope, and the Super-RADOT telescope facility in the South Pacific. Other USSPACECOM sensor facilities also will support the mission as necessary. This experiment enables the correlation of controlled empirical optical and radar debris signatures of targets whose physical dimensions, compositions, reflectivity, and electromagnetic scattering properties are precisely known, thereby verifying or improving the sensors' accuracy and ultimately leading to better knowledge of the debris environment.

The ODERACS-II experiment, whose Principal Investigator is Gene Stansbery of Johnson, will release six targets, three spheres and three dipoles of different sizes from the Shuttle payload bay. The targets will be observed, tracked and recorded using ground-based radar and optical sensors. The spheres are composed of polished, blackened, and whitened stainless steel and aluminum. The sphere group consists of one 2-inch diameter stainless steel sphere, one 4-inch diameter aluminum sphere and one 6-inch diameter aluminum sphere. The dipoles consist of platinum alloys chosen to maximize orbital lifetime. The dipole group consists of one 1.740 inches x .040 inch diameter wire and two 5.255 inches x .040 inch diameter wires. The targets will be ejected retrograde along the Shuttle velocity vector at velocities between 1.4 and 3.4 meters per second (4.5 to 11.1 feet per second). The estimated average orbital lifetime of the targets ranges from about 20 to 280 days and is highly dependent on solar flux and the resultant atmospheric heating. All targets will completely burn up during reentry.

CGP/ODERACS/CONCAP II
(FORWARD VIEW)





CGP/ODERACS/CONCAP II
(AFT VIEW)

STS-63 EVA ACTIVITIES

STS-63 will continue laying the groundwork for future space activities on the flight's seventh day when Mission Specialists Mike Foale and Bernard Harris perform an almost five-hour spacewalk to test spacesuit modifications and practice handling large objects in microgravity.

During the extravehicular activity, Foale will carry the designation EV1 and will be wearing red stripes on the legs of his spacesuit, while Harris will be EV2. Pilot Eileen Collins will assist the spacewalkers from inside the crew cabin by monitoring their progress through the EVA timeline and will serve as the primary communicator between the spacewalkers and the crew inside Discovery. Russian Mission Specialist Vladimir Titov will operate the robot arm during the spacewalk and will assist Harris and Foale into their suits.

The spacewalk has two specific objectives: to evaluate modifications to the spacesuits that provide astronauts with better thermal protection from cold and to perform several mass handling exercises in a series of activities designed to increase NASA's experience base as it prepares for the on-orbit assembly of the International Space Station.

Past EVA experience has demonstrated that, even with the spacesuit's thermal controls, a spacewalking astronaut can become chilled when working in open or shaded areas. During most Shuttle EVA's, crew members work in the payload bay where the Orbiter's radiated heat keeps the spacewalkers warm. The assembly of the International Space Station, however, will require astronauts to work in extremely cold conditions frequently.

Several modifications have been made to the spacesuit systems to prevent astronauts' hands from becoming cold. On the liquid cooling garment, for example, the cooling tubes running down the arms have been bypassed so the spacewalkers' arms are not cooled. Additional layers of material have been added to the thermal undergarment and the exterior of the suit's gloves for warmth.

The evaluation of the modifications will be performed when Discovery is positioned with its belly pointed toward the Sun and the payload bay shadowed, creating the coldest environment possible. The robot arm, with Foale and Harris on it, will be extended above the payload bay, clear of the Orbiter's radiated heat. Foale and Harris will stay in that position without performing any work for about 15 minutes, all the time providing ground engineers with objective feedback and data on their thermal comfort levels.

The mass handling exercises will be performed with the Spartan spacecraft, which will have been returned to the payload bay only a few minutes before start of the EVA. The exercise will begin with Foale in a Portable Foot Restraint on the end of the robot arm and Harris in a restraint on the Spartan's support structure.

Titov will move Foale into position to grab Spartan from its berthing platform. Foale will then hand the satellite to Harris who will perform a series of translation and rotation maneuvers. When he is finished, Harris will hand the satellite back to Foale, who will repeat the activity on the end of the robot arm.

The entire EVA is scheduled for 4 hours, 50 minutes, but may be shortened if the Spartan retrieval is delayed.

SPACEHAB-3

The primary payload for the STS-63 mission is SPACEHAB-3, a pressurized, commercially-developed space research laboratory located in the forward end of Discovery's cargo bay. The laboratory is accessed by crew members from the Orbiter's middeck through a tunnel adapter connected to the vehicle's airlock. This is the third flight of SPACEHAB--the first two highly-successful missions were flown in June, 1993, and February, 1994, aboard STS-57 and STS-60, respectively.

Under a contract awarded in 1990 with SPACEHAB, Inc., of Arlington, VA, NASA is leasing space aboard SPACEHAB-3 to support the Agency's commercial development of space program by providing access to space to test, demonstrate or evaluate techniques or processes in the environment of space and thereby reduce operational risks to a level appropriate for commercial development. The 5-1/2 ton space module significantly increases the pressurized working and storage volume normally available aboard the Shuttle.

New System Features

As a result of experience gained on SPACEHAB-1 and -2, it is clear that there are some resources the SPACEHAB shares with the Space Shuttle that are very scarce. One of those resources is crew time. SPACEHAB, Inc., has developed two new system features to significantly reduce the demands on crew time. The first new feature is a video switch to reduce the demand for crew time in video operations, and the second new feature is an experiment interface to the SPACEHAB telemetry system to reduce the demand for crew time in experiment data down link.

The SPACEHAB video system uses camcorders that are tied to the Orbiter closed circuit television system and then down linked through the Orbiter. On SPACEHAB-1 and -2, the crew set up the camcorders and manually switched from one camera scene to another, a time-consuming operational arrangement. For SPACEHAB-3, SPACEHAB, Inc., installed a video switching unit allowing up to eight camcorders to be cabled into the SPACEHAB video switch. Then, by ground control, one of the camcorders can be switched into the Orbiter system for down link. Also, another one of the camcorders can collect a digital image on a freeze frame and send it down through SPACEHAB's telemetry stream, independent of other Orbiter video down link operations. This new video switch and digital television down link capability will provide operational flexibility that will be very valuable on this flight and on subsequent flights.

SPACEHAB, Inc., also has enhanced the experiment data interface with the SPACEHAB telemetry system in the interest of on-orbit efficiency. The system now allows an experimenter with a standard RS232 computer interface to tie directly into the system and send continuous information down to the ground, off loading this task from the crew and enhancing ground controller monitoring of experiment status.

Also, on the roof of the SPACEHAB laboratory there will be two 12-inch diameter windows installed for STS-63. One window will have a NASA docking camera in it to assist in the Mir proximity operations.

Experiments

Over 20 SPACEHAB-3 experiments, sponsored by NASA's Offices of Space Access and Technology and Life and Microgravity Sciences and Applications together with the Department of Defense, represent a diverse cross-section of technological, biological and other scientific disciplines and were developed for flight by an equally-diverse complement of university, industry and government organizations nationwide. A summary of experiments to be flown aboard STS-63 follows:

The ASTROCULTURE™ payload is sponsored by the Wisconsin Center for Space Automation and Robotics (WCSAR), a NASA Center for the Commercial Development of Space (CCDS), located at the University of Wisconsin at Madison.

Extended space ventures that involve human presence will require safe and reliable life support at a reasonable cost. Plants play a vital role in the life support system present here on Earth. Likewise, it can be expected that plants will be a critically important part of a life support system in space because they can be a source of food while also providing a means of purifying air and water. Currently, no satisfactory plant-growing unit is available to support long-term plant growth in space. Several industry affiliates including Automated Agriculture Assoc., Inc., Dodgeville, WI; Quantum Devices, Inc., Barneveld, WI; and Orbital Technologies Corp., Madison, WI; together with WCSAR have been involved with this cooperative program to develop the technologies needed for growing plants in a space environment.

The objective of the ASC series of flights is to validate the performance of plant growth technologies in the microgravity environment of space. Each of the flight experiments involves the incremental addition of important subsystems required to provide the necessary environmental control for plant growth. The flight hardware is based on commercially-available components thereby significantly reducing the hardware costs. The information from these flight experiments will become the basis for developing large scale plant-growing units required in a life support system. In addition, these technologies also will have extensive uses on Earth, such as improved dehumidification/humidification units, water-efficient irrigation systems, removal of hydrocarbons and other pollutants from indoor air and energy-efficient lighting systems for plant growth.

The ASC-1 flight experiment, conducted during the USML-1 mission on STS-50, evaluated the WCSAR concept for providing water and nutrients to plants.

The ASC-2 flight experiment, conducted during the SPACEHAB-1 mission on STS-57, provided additional data on the water nutrient delivery concept, plus an evaluation of the light-emitting diode-based plant lighting concept. The ASC-3 flight experiment, included in the SPACEHAB-2 STS-60 mission, provided data for a concept to control temperature and humidity in a closed-plant growth chamber. Results from these flight experiments confirmed the validity of these concepts for use in a space-based growing unit.

The ASTROCULTURE™ ASC-4 flight experiment aboard the STS-63 mission will be the first to include plants. Wheat seedlings and special fast-growing plants developed at the University of Wisconsin-Madison College of Agriculture and Life Sciences will be used to confirm the performance of the ASC environmental control subsystems. Also being evaluated is the Zeoponics nutrient composition control system developed by researchers at NASA's Johnson Space Center, Houston.

Demonstration of successful plant growth in space using the ASTROCULTURE™ unit will represent a major advance in the ability to provide superior environmental control for plant growth in an inexpensive and reliable flight package.

A supplemental experiment is being conducted in cooperation with researchers at NASA's Ames Research Center, CA. This experiment is referred to as the Fluid Dynamics in a Porous Matrix (FDPM) experiment and consists of three test units being flown as stowage. This experiment will investigate capillary migration of liquids in granular beds. This knowledge is essential for the optimization of a substrate-based nutrient and water delivery system for plant growth in space.

The flight hardware for this mission is accommodated in a SPACEHAB locker located in the module, and weighs approximately 50-pounds. The ASC-4 flight unit includes humidity and temperature control, lighting, water and nutrient delivery, nutrient composition control, CO2 control, atmospheric contaminant removal, video and data acquisition. These subsystems provide essentially all the environmental regulation needed for plant growth. The next ASC flight experiment beyond SPACEHAB-3 will be a 16-day experiment on STS-73 to study plant starch metabolism and carbohydrate translocation in potato leaves.

Principal Investigator on ASTROCULTURE™ is Dr. Raymond J. Bula, WCSAR.

BioServe Pilot Laboratory-3 (BPL-3)

The BioServe Pilot Laboratory-3 payload is sponsored by BioServe Space Technologies, a NASA Center for the Commercial Development of Space (CCDS) based at the University of Colorado, Boulder, CO, and Kansas State University, Manhattan, KS.

BioServe developed the BPL to provide a "first step" opportunity to companies interested in exploring low-gravity research in a wide variety of life sciences areas with primary emphasis on cellular studies. For STS-63, two series of investigations will be carried out on bacterial products and processes.

BioServe will examine Rhizobium trifolii behavior in microgravity. Rhizobia are special bacteria that form a symbolic relationship with plants. The bacteria infect the plants early in seedling development to form nodules on the plant roots. The bacteria in these nodules derive nutritional support from the plant while, in turn, providing the plant with nitrogen fixed from the air. Plants that form such relationships with rhizobia are called legumes and include alfalfa, clover and soybean. Such plants do not require synthetic fertilizers to grow. In contrast, many important crop plants such as wheat and corn are dependent on synthetic fertilizers since they do not form symbolic relationships with rhizobia. Understanding the multi-step process associated with rhizobia infection of legumes may make it possible to manipulate the process to cause infection of other crop plants. The potential savings in fertilizer production would be tremendous.

Another BioServe investigation concerns the bacteria E. Coli. These bacteria are normally found in the gastrointestinal tracts of mammals, including man. E. Coli have been thoroughly studied as a model system for bacterial infection, population dynamics and genetics research. E. Coli has been manipulated to produce bacteria capable of secreting important pharmaceutical products and also has served as a model for bacteria used in waste treatment and water reclamation.

BioServe will study these bacteria to determine changes in growth and behavior that occur as a consequence of exposure to microgravity. The commercial objectives include understanding and controlling bacterial infection in closed environments; exploiting bacteria and other microorganisms in the development of ecological life support systems and waste management; determining the opportunity for enhanced genetic engineering; and enhanced pharmaceutical production using bacterial systems. For STS-63, the BPL will consist of 40 Bioprocessing Modules (BPMs) stowed in a standard locker in the middeck of Discovery. The BPMs will contain the biological sample materials. The stowage locker also will contain an Ambient Temperature Recorder which will provide a temperature history of the payload throughout the mission.

For most of the investigations, simultaneous ground controls will be run. Using similar hardware and identical sample fluids, ground personnel will activate and terminate BPMs in parallel with the flight crew. Synchronization will be accomplished based on voice downlink from the crew. Ground controls will be conducted at the SPACEHAB Payload Processing Facility at Cape Canaveral, FL.

After the Orbiter has landed, the stowage locker containing the BPMs will be turned over to BioServe personnel for de-integration. Some sample processing will be performed at the landing site. However, most BPMs will be shipped or hand-carried back to the sponsoring labs for detailed analysis.

Dr. George Morgenthaler, Director of the BioServe CCDS, is Program Manager. Dr. Louis Stodieck and Keith Pharris, also of BioServe, are responsible for mission management.

Biological Research in Canisters (BRIC-3)

Research on carbohydrate-rich plants is the subject of the Biological Research in Canisters payload.

Soybeans and other carbohydrate-rich plants would provide an ideal food source for long-duration space missions, including Space Station. This experiment will investigate the basic processes involved in carbohydrate production by observing how exposure to microgravity affects the production of consumable food products.

In this research, soybean seeds are rolled in germination paper and placed in tubes located inside BRIC canisters. The experiment will be sealed and housed in the middeck of the Space Shuttle. The experiment itself is passive, however, the crew is required on mission day five to transfer one canister to the freezer. Freezing these samples will dramatically increase the science return for this investigation by allowing an examination of plants developed in microgravity to be contrasted with control groups developed in regular gravity.

The experiment will be removed immediately after landing in order to freeze the second canister's soybean seedlings before the effects of gravity are re-established.

BRIC experiments are sponsored by NASA's Office of Life and Microgravity Sciences and Applications and managed by NASA's Kennedy Space Center, FL. Dr. Christopher Brown, Plant Space Biology Program, Kennedy Space Center, is Principal Investigator.

Commercial Generic Bioprocessing Apparatus (CGBA-6)

The Commercial Generic Bioprocessing Apparatus-6 payload is sponsored by BioServe Space Technologies, a NASA Center for the Commercial Development of Space (CCDS), located at the University of Colorado, Boulder, and Kansas State University, Manhattan, KS. The purpose of the CGBA is to allow a wide variety of sophisticated biomaterials, life sciences and biotechnology investigations to be performed in one payload in the low gravity environment of space.

Corporate affiliates include the Center for Cancer Research, Manhattan, KS; Kansas Agricultural Experiment Station, Manhattan, KS; NeXagen, Boulder, CO; Synchrocell, Inc.; and Water Technology Industries.

During the STS-63 mission, BioServe will support 26 separate commercial investigations which can be classified in three application areas: biomedical testing and drug development; small agricultural and environmental systems development; and biomaterials and biotechnology systems development.

In the Biomedical Testing and Drug Development category, eight biomedical models will be tested in microgravity. Of the eight models, three are related to immune disorders: one will study the ability of macrophage cells to function normally; one will study the ability of T-lymphocyte cells to secrete essential communication modules; and one will study the ability of immune system cells to respond to infectious-type materials. The other five models are related to bond and developmental disorders, wound healing, cancer and cellular disorders. Analysis of the test results will provide information to better understand diseases and disorders that affect human health, including cancer, osteoporosis and AIDS. In the future, these models may be used for the development and testing of new drugs to treat these diseases.

In the category of Small Agricultural and Environmental Systems Development, BioServe will conduct seven ecological studies: five on seed germination and seedling processes; one on brine shrimp; and one on a new material's ability to control build-up of unwanted bacteria and other microorganisms.

In the third category, Biomaterials and Biotechnology Systems Development, BioServe will investigate eleven different biomaterials and biotechnology products and processes in the following areas: large protein and RNA crystals for use in commercial drug development; assembly of virus shells for use in a commercially-developed drug delivery system; enzymatic breakdown of fibrin, collagen and cellulose materials with application to engineering of tissue implants; bacterial systems with application to understanding proliferation, antibiotic resistance, pharmaceutical production and response to environmental stress; and evaluation of the use of microscopic magnetic particles, called magnetosomes, to form strong, collagen-based materials for possible use in artificial implants.

Some experiments will require astronaut involvement while others will be automated. For most investigations, simultaneous ground controls will be run in synchronization with flight crew participation.

After Discovery has landed, the stowage lockers will be retrieved and turned over to BioServe personnel for de-integration. Some sample processing will be performed at the SPACEHAB Payload Processing Facility in Florida, but most will be shipped or hand-carried back to the sponsoring laboratories for detailed analysis.

Dr. George Morgenthaler, Director of the BioServe CCDS, is Program Manager for CGBA. Dr. Louis Stodieck and Keith Pharris, also of BioServe, are responsible for mission management.

CHARLOTTE

An experimental robotic device built by McDonnell Douglas Aerospace (MDA) will fly aboard the SPACEHAB module to demonstrate automated servicing of experimental payloads and allow remote video observation aboard the pressurized space research laboratory.

Through the compact device, roughly the size of a small microwave oven, investigators hope to demonstrate the advantages of a simple, safe, low power, rigid, easily-installed robotic device to relieve the workload of future flight crews.

Nicknamed "Charlotte" by its MDA developers, this robot does not employ gantries, jointed-arms or complicated systems. Charlotte, when deployed by the STS-63 crew, will be suspended on cables which are relatively easy to install and remove.

Among Charlotte's experimental objectives are to operate knobs, switches and buttons inside the SPACEHAB module. The robot also has the capability to changeout experimental samples and data cartridges and perform many other inspection and manipulation tasks thereby automating many routine procedures and freeing the flight crew to perform other tasks.

CHROMEX-6

In previous spaceflight experiments, it has been observed that plants exposed to microgravity exhibit abnormalities in cell shape and structure. Many of these observations can be linked to changes in the plant cell walls. These cell walls of plants determine many aspects of plant growth, including shape, growth rate, cell-cell recognition, and composition of fiber to name a few. Many of the biochemical features that characterize mature, functional cell walls are catalyzed by cell wall-associated enzymes. The CHROMEX-6 study will help explain the role of these enzymes in establishing normal cell wall structure and function.

The species being studied is Superdwarf Wheat (*Tritucum aestivum*) which will be planted 48 hours prior to flight. These plants will develop under laboratory conditions until specimens are loaded for flight. The plants will be loaded into the Orbiter during the late load timeframe. Upon return to Earth, the plants will be dissected, fixed by exposure to cryogenics, and analyzed for cell wall associated enzymes.

CHROMEX-5, which flew on STS-68, examined the effects of space flight on early reproductive events in plants and was the first occurrence of successful pollination, fertilization and embryo development (formation of young seed) for a U.S. investigator. A longer-duration flight opportunity will be necessary in order to produce mature seed from seed that is planted in space.

Earlier attempts at successful plant reproduction in space flight (CHROMEX-3 and 4) may have failed because of poor airflow or replacement in the chambers housing the plants in the Plant Growth Unit (PGU) and/or insufficient CO_2 availability to the plants due perhaps to the microgravity environment lacking connective air movement. CHROMEX-5 employed the new active Air Exchange System (AES) for the PGU for the first time to enhance air circulation to and around the plants. And the CHROMEX-5 plants are being analyzed for increased carbohydrate levels and other evidence of improved growth and development.

The experiment is sponsored by NASA's Office of Life and Microgravity Sciences and Applications and managed by NASA's Kennedy Space Center, FL. Dr. Elizabeth E. Hood, Utah State University, is Principal Investigator.

Commercial Protein Crystal Growth (CPCG)

The Commercial Protein Crystal Growth (CPCG) experiments aboard STS-63 are sponsored by the Center for Macromolecular Crystallography (CMC), based at the University of Alabama at Birmingham. The CMC is a NASA Center for the Commercial Development of Space (CCDS) which forms a bridge between NASA and private industry by developing methods for the crystallization of macromolecules in microgravity. These crystals are used to determine the three-dimensional structure of the molecules by x-ray crystallography. The structural information not only provides a greater understanding of the functions of macromolecules in living organisms, but it also provides scientific insight into the development of new drugs.

By the technique of protein crystallography, crystals of purified proteins are grown in the laboratory, and x-ray diffraction data are collected on these crystals. The three-dimensional structure is then determined by analysis of this data. Unfortunately, crystals grown in the gravity environment of Earth frequently have internal defects that make such analysis difficult or impossible. Space-grown crystals often have fewer defects and are much better than their Earth-grown counterparts.

The protein crystal growth experiments aboard STS-63 will consist of two crystallization systems: the Vapor Diffusion Apparatus (VDA) and the Protein Crystallization Facility (PCF).

The objective of the VDA experiments aboard STS-63 is to use the microgravity environment to produce large, well-ordered crystals that yield x-ray diffraction data that are superior to the data from their Earth-grown counterparts. This will be the 18th flight of the Vapor Diffusion Apparatus experiments, and the series of experiments has produced the highest-quality crystals ever grown of several proteins. Crystallographic analysis has revealed that on average 20% of proteins grown in space in the VDA are superior to their Earth-grown counterparts.

The objective of the PCF experiment, contained in a thermal control enclosure located in the middeck, will be to crystalize human alpha interferon protein. Alpha interferon is a protein pharmaceutical that currently is used against human viral hepatitus B and C. The objective is to discover the next generation alpha interferon pharmaceuticals and formulations.

With continued research, the commercial applications developed using protein crystal growth have phenomenal potential, and the number of proteins that need study exceeds tens of thousands. Current research, with the aid of pharmaceutical companies, may lead to a whole new generation of drugs that could help treat diseases such as cancer, rheumatoid arthritis, peridontal disease, influenza, septic shock, emphysema, aging and AIDS.

A number of pharmaceutical companies partner with the CMC including: BioCryst Pharmaceuticals, Inc; Eli Lilly and Co.; Schering-Plough; DuPont Merck Pharmaceuticals; Eastman Kodak; Upjohn Co.; Smith Kline Beecham Pharmaceuticals; and Vertex Pharmaceuticals, Inc. Principal Investigator for the STS-63 protein crystal growth experiments is Dr. Larry DeLucas, Director of the CMC.

Equipment for Controlled Liquid Phase Sintering Experiments (ECLIPSE)

The Consortium for Materials Development in Space (CMDS), based at the University of Alabama in Huntsville (UAH) has developed the Equipment for Controlled Liquid Phase Sintering Experiments (ECLIPSE). This furnace was developed in a very rapid and cost-effective manner. Development of ECLIPSE was supported by Wyle Laboratories. It successfully flew on the first two SPACEHAB missions and is now available as space-qualified hardware and is a key part of the nation's commercial space infrastructure.

The SPACEHAB-3 ECLIPSE experiment will investigate the "Liquid Phase Sintering" (LPS) of metallic systems. "Sintering" is a well-characterized process by which metallic powders are consolidated into a metal at temperatures only 50% of that required to melt all of the constituent phases. In LPS on Earth, a liquid coexists with the solid which can produce sedimentation, thus producing materials that lack homogeneity and dimensional stability. To control sedimentation effects, manufacturers limit the volume of the liquid. The ECLIPSE experiment examines metallic composites at or above the liquid volume limit to understand more fully the processes taking place and to produce materials that are dimensionally stable and homogeneous in the absence of gravity. The concept of "defect trapping in microgravity" will be pursued during this experiment. The knowledge gained from the experiments will be applied toward preventing or controlling defect formation.

This flight of the ECLIPSE payload is building on the experience of other ECLIPSE flights on sub-orbital rockets. Sub-orbital flights have provided 1-3 minutes of sample processing time. Longer flight durations are made possible by the Shuttle. The STS-63 flight will be the longest melt period (approximately one hour) for the copper series. Copper is the metal that melts and provides the liquid phase in the sintering process.

Composites of hard metals in a tough metal matrix have excellent wearing properties of the hard material and the strength of the touch material. Applications of such a composite include stronger, lighter, more durable metals for bearings, cutting tools, electric brushes, contact point and irregularly-shaped mechanical parts for high stress environments.

Industry partners on the ECLIPSE experiment, besides Wyle Laboratories, are Kennametal, Inc.; Automatic Switch Co.; Parker Hannifin Corp.; and Machined Ceramics. Principal Investigator for ECLIPSE is Dr. James E. Smith, Jr., Associate Professor and Chairman, Department of Chemical and Materials Engineering at UAH.

Fluids Generic Bioprocessing Apparatus-1 (FGBA-1)

The Fluids Generic Processing Apparatus-1 is the first of three commercial payloads being developed by BioServe Space Technologies. BioServe is a NASA Center for the Commercial Development of Space (CCDS) located at the University of Colorado, Boulder. A consortium of private businesses, universities and government, including The Coca-Cola Company, Atlanta, GA; Martin Marietta, Denver, CO; Ohmeda, Boulder, CO; University of Colorado, Boulder; Kansas State University, Manhattan, KS; and NASA's Office of Space Access and Technology, Washington, DC, have combined resources to sponsor the FGBA commercial program.

The consortium has a major longe-range objective in advancing fluid management technology in microgravity. Consistent with this objective, this first BioServe FGBA experiment represents a significant opportunity to obtain fundamental data on containment, manipulation and transfer of pressurized, supersaturated two-phase fluids. During STS-63, this program is expected to further the commercial objectives of The Coca-Cola Company in developing both terrestrial and space applications. The Coca-Cola Company has a strong interest in developing hardware to carbonate water on demand and to mix and dispense beverages with minimal loss of carbonation. Developing technology to accomplish these objectives in microgravity may likely evolve into terrestrial applications that could further the long-range research and development objectives of The Coca-Cola Company.

This flight will provide baseline data on changes in astronauts' taste perception of beverages consumed in microgravity. The beverages to be used in the evaluation are Coca-Cola and diet Coke. The taste perception changes experienced by astronauts on-orbit will be compared to their taste perception of these beverages in matched pre- and post-flight ground controls involving the same crew members.

Dr. George Morgenthaler, Director of the BioServe CCDS, is Program Manager for the FGBA experiment. Drs. Louis Stodieck and Alex Hoehn, also of BioServe, are responsible for mission management. Dr. Ashis Gupta is the principal engineer for this experiment for The Coca-Cola Company.

Gas Permeable Polymer Materials (GPPM)

The Gas Permeable Polymer Materials (GPPM) payload is sponsored by NASA Langley Research Center, Hampton, VA, and its commercial affiliate, Paragon Vision Sciences of Phoenix, AZ.

Plastic materials, which are made of very large molecules called "polymers", are used in everyday life in many ways. Some polymers prevent gases, such as oxygen, from passing through. These polymers are used in keeping foods fresh for long periods of time in a refrigerator or freezer. Other polymers allow one or more gases to pass through. These polymers, called gas permeable polymeric materials, also have many uses. Gravity may affect many properties of the polymer while it is being made. As early as 1984, it was suggested that these effects may be eliminated or at least reduced if the polymer were made in the low gravity of space flight.

The Gas Permeable Polymer Materials (GPPM) flight experiment is a follow on to the first GPPM flight, which took place in July 1993. The purpose of these flights is to determine if certain types of polymers made in low gravity while the Space Shuttle is in orbit, differ greatly from the same polymers made at the same time on the ground. The current flight will evaluate new materials based on results from the first GPPM flight.

This second flight also will determine if polymers can be made from monomers which cannot be mixed on the ground. As in the first GPPM mission, there also will be ground experiment samples tested to compare the results of the polymer manufacturing process in a gravity-based setting.

Gas permeable polymeric materials have many uses. One use is the potential improvement in contact lenses for long-term wear, allowing greater oxygen to pass through the lens and adding comfort to the wearer. Paragon Vision Sciences is a leading manufacturer of polymers for contact lenses, and is using these flight activities to determine if formation of polymers in microgravity has application to their line of optical products.

There are other potential applications of polymers developed in microgravity, including medical applications such as dialysis and blood gas monitoring, and industrial processes associated with the manufacture of pure gases. Langley researchers are interested in further exploring other uses for polymer materials developed in low gravity.

After the return of the samples from the STS-63 mission, Paragon Vision Sciences and NASA researchers will assess the mission results and make the determination on what the next steps will be. Langley researchers will use the results from the flight to determine what might be possible new research paths to take using polymer development in microgravity.

Handheld Diffusion Test Cell (HH-DTC)

The Handheld Diffusion Test Cell (HH-DTC) apparatus will evaluate experiment chambers designed for the new Observable Protein Crystal Growth Apparatus (OPCGA), which will use sophisticated optical techniques to analyze the growth of individual crystals in orbit.

Scientists have been growing protein crystals in space for almost a decade. There is good evidence that in about 25 percent of the cases crystals can be grown in space that are superior to any grown on Earth. Determining exactly why some space-grown crystals are better is the goal of the Observable Crystal Growth System and the transparent test cells being tested on this flight. If scientists can pinpoint the underlying mechanisms which influence growth in space versus that on Earth, the fundamental knowledge they gain could suggest improved methods of crystal growth in orbit as well as in Earth-based laboratories. Past studies on small-molecule crystal growth, for instance involving semiconductors and laser optics, have produced such improved methods.

The STS-63 experiment also will evaluate the growth of protein crystals by diffusion of one liquid into another, since crystals produced by the liquid diffusion process will be better suited for observation experiments on upcoming flights.

The majority of previous Shuttle protein crystal growth experiments have involved growth by vapor diffusion, concentrating a droplet by evaporation to force the remaining material to crystallize. However, planned OPCGA observations cannot be done with the round droplets found in vapor diffusion.

In liquid-liquid diffusion, different fluids are brought into contact but not mixed. Over time, the fluids will diffuse into each other through random motion of molecules. The gradual increase in concentration of the precipitant within the protein solution causes the proteins to crystallize. Liquid-liquid diffusion is difficult on Earth because differences in solution densities allow mixing by gravity-driven thermal convection. In addition, the greater density of the crystals allows them to settle into inappropriate parts of the cell.

Four HH-DTC units containing four test cells each will be flown, for a total of 16 test cells. The end of the test cells where crystals will grow and the containment housing are made of clear plastic, so the crew can photograph growth during the mission. Three HH-DTC units will be housed in Spacehab lockers, and the other will be mounted on the Spacehab module wall for periodic video recording.

Each test cell has three chambers: protein solution, buffer solution, and precipitant solution. The buffer solution chamber cuts across the width of a shaft between protein and precipitant solutions. Before the experiment, a valve is positioned so each fluid is isolated from the others. An astronaut will activate the experiment by rotating the valve 90 degrees, so the buffer contacts the protein and precipitant and the three form a single volume. The rotating valve minimizes liquid movement, limiting alteration of the liquids' shapes and volumes. When the three liquids are in contact, they will slowly diffuse into each other. The crew will close the valves before return to Earth.

Candidate proteins for growth in the HH-DTC include several which have been crystallized in previous Shuttle experiments to allow comparisons of results from the different growth methods. The proteins include lysozyme, hemoglobin, satellite tobacco mosaic virus, concanavalin B and canavalin.

Dr. Alexander McPherson, Jr., of the University of California, Riverside, is Principal Investigator for HH-DTC.

Immune System Experiment - 2 (IMMUNE-2)

The IMMUNE-2 experiment is a commercial middeck payload sponsored by BioServe Space Technologies. BioServe is a NASA Center for the Commercial Development of Space at the University of Colorado, Boulder, and Kansas State University, Manhattan. The corporate affiliate leading the IMMUNE-2 investigation is Chiron Corporation, Emeryville, CA. NASA's Ames Research Center, Mountain View, CA, provides payload and mission integration support.

The goal of IMMUNE-2 is to further understand and define the ability of Polyethylene Glycol-Interleukin-2 (PEG-IL2) to prevent or reduce the detrimental effects of space flight on immune responses in rats.

This is a follow-on experiment to IMMUNE-1, which showed that PEG-IL2 did induce a trend toward a reduction in space flight-caused changes in immune responses. These experiments may result in greater understanding of immunodeficiencies in general. In particular, they may lead to development of new therapeutic approaches for dealing with the effects of space flight on the human immune system and on physiological systems affected by the immune system.

Hardware for the IMMUNE-2 experiment consists of two suitcase-size Animal Enclosure Modules (AEMs) in the Shuttle's middeck area. Ames Research Center developed the AEMs to support NASA's space life sciences research program. The AEMs provide a safe habitat and all life support functions for rats during a Space Shuttle mission. AEMs have had a very successful flight history, with 13 flights in support of other NASA investigations. IMMUNE-2 is the sixth experiment to use the AEM in support of activities to develop the commercial uses of space.

Each of the two AEMs will hold six white male rats. Six of the rats will be treated pre-flight with a prescribed dosage of a compound similar to the commercially available recombinant Interleukin-2 (IL-2). IL-2 is known to stimulate the immune system. The compound, PEG-IL2, is longer-lasting than recombinant Interleukin-2. Scientists hope it will reduce or prevent the suppression of the immune system seen in rats flown in space. The other six rats will receive a placebo.

The rats will live in an environment similar to that of the astronauts in terms of launch stress, length of exposure to microgravity, and the forces of Shuttle re-entry and recovery. These conditions are known to result in a suppression of the immune system similar to "shipping fever" in cattle. The utility of PEG-IL2 in preventing space flight-induced effects on the immune system may lead to its use as a therapeutic treatment for shipping fever in animals on Earth.

The longer-lasting PEG-IL2 probably will be useful in clinical settings as well. It might reduce the frequency of injections required, to perhaps once a week instead of up to three times a day, as is necessary with recombinant IL-2. The development of recombinant IL-2 for treatment of some human cancers is still being investigated, although it is licensed for high-dose therapy of kidney cancer in humans.

Based on recent experimental findings, PEG-IL2 (and recombinant IL-2) appears to have potential as an immunoregulatory agent leading to control of microbial infections. As such, PEG-IL2 may become part of a therapy used to treat various opportunistic infections associated with AIDS and other non-AIDS related infectious diseases.

It also may become useful for the nation's aging population, because aging individuals show decreased levels of Interleukin-2. The PEG-IL2 treatment could accompany flu shots to bolster the immune system of the elderly. These important applications present exciting commercial opportunities for Chiron Corp.

Dr. Robert Zimmerman, of the Chiron Corp., Emeryville, CA, is Principal Investigator for the IMMUNE-2 experiment.

National Institutes of Health- C-3

The NIH-C-3 payload is composed of three collaborative biomedical experiments sponsored by NASA and the National Institutes of Health (NIH). These three experiments will make use of a computerized tissue culture incubator known as the Space Tissue Loss (STL) Culture Module. STL was developed at the Walter Reed Army Medical Center in Washington, DC, to study cells under microgravity.

These three experiments are sponsored by NASA's Office of Life and Microgravity Sciences and Applications and the National Institute of Arthritis and Musculoskeletal and Skin Diseases:

1. Effects of Hypogravity on Osteoblast Differentiation
   (Animal and Human Physiology: Bone loss)

Principal Investigator: Dr. Ruth Globus, Department of Medicine
University of California at San Francisco

Several U.S. Shuttle flights and the Russian Cosmos biosatellite series of space flights showed that weightlessness causes bone loss in rats and humans, apparently because of abnormal functions of the bone-forming cells called osteoblasts. The investigators do not yet know whether the reduced gravitational environment experienced by astronauts in space directly harms osteoblast function, or alternatively, whether changes in hormones or other systemic factors lead to the bone loss.

The investigators will test the hypothesis that exposure to space flight causes abnormal function of bone-forming osteoblasts grown in culture, even though those cells are isolated from systemic influences. An experiment using isolated rat osteoblasts flown on the Shuttle (STS 59) in the STL previously showed that space flight might directly impair both the energy metabolism and the mature function of isolated osteoblasts. Comparable changes in the activity of astronaut's osteoblasts during space flight may contribute to their loss of bone mass.

Investigators will confirm and extend previous results; they will determine whether space flight regulates specific genes which are needed for normal osteoblast function.

They also will evaluate the quality of bone-like tissue formed by the cultured osteoblasts during space flight. They expect information gathered from this experiment to contribute substantially to the understanding of how gravity regulates bone cell function, a basic question that remains largely unanswered.

2. Molecular and Cellular Analysis of Space Flown Myoblasts
(Animal and Human Physiology: Muscle loss)

Principal Investigator: Dr. David A. Kulesh, Capt., USAF, Armed Forces Institute of Pathology, Washington, DC

While many of the overt physiological effects of microgravity can be compensated for by various countermeasures, effects at the cellular and molecular levels may require other means of intervention. However, little detail is known about the direct effect of microgravity at the molecular and cellular level. Insight into the cellular and molecular events responsible for muscle cell growth and development come in large part from in-vitro studies with established cell lines. This investigation will use a well-characterized rat skeletal muscle cell line, in the STL module. The specific goals of the muscle cell culture model are to augment the whole animal model studies and simplify the molecular and cellular analysis of microgravity effects on muscle tissue in general.

For Dr. Kulesh's research, rat muscle cells will be cultured in individual cell cartridges and sustained in the STL module. The experiment itself is passive, requiring no in-flight manipulation except for temperature monitoring. The experiment requires special preparations before launch and immediate removal from the Shuttle after landing, to access the effects of microgravity on the growth of muscle cells, before the effects of full gravity are re-established.

Post flight experiments with the space flown muscle cells will evaluate the overall effect of microgravity on cellular characteristics (shape, doubling times, etc.). In addition, the investigator will begin to assess possible changes in the expression of proteins and genes after their exposure to microgravity.

Gravity may play an integral role in the biological functioning of single cells. Information on the effects of gravity on muscle cell development will help scientists overcome the deleterious effects of space travel. These studies in weightlessness will also contribute to the understanding of cell proliferation, cell differentiation, development and wound healing.

3. Influence of Space Flight on Bone Cell Cultures
(Animal and Human Physiology: Bone loss)

Principal Investigator: Dr. William J. Landis, Children's Hospital Boston, MA

In humans and other vertebrates, the weightless environment of space flight causes defective skeletal growth, marked by a loss of bone mass and a change toward lower bone maturity. The development of defective bone is believed to involve matrix production controlled by bone cells, bone mineralization, or an interaction between bone matrix production and bone mineralization.

The investigators will use established cell lines of chicken osteoblasts in the STL module. The investigators will analyze rates of cell growth, aspects of collagen and bone development, and mineralization both inside and outside the cultured cells. Data obtained in the flight experiments should provide knowledge on the effects of gravity on osteoblast activity and function, protein development, and mineralization. The studies will have implications for long duration space flight, as well as application to the diagnosis and treatment of prolonged skeletal immobilization or mineral abnormalities.

Protein Crystallization Apparatus for Microgravity

The Protein Crystallization Apparatus for Microgravity (PCAM), to be carried in the Shuttle middeck, tests a new design for growing large quantities of protein crystals in orbit. The apparatus holds more than six times as many samples as are normally accommodated in the same amount of space.

Proteins are important, complex biochemicals that serve a variety of purposes in living organisms. Determining their molecular structures will lead to a greater understanding of how those organisms function. Knowledge of the structures also can assist the pharmaceutical industry in the development of disease-fighting drugs.

Many proteins can be grown as crystals and their molecular structure determined through analysis of the crystals by X-ray crystallography. Unfortunately, crystals grown in the gravity environment of Earth often have internal defects that make such analysis difficult or impossible. As demonstrated on Space Shuttle missions since 1985, some protein crystals grown in space — away from gravity's distortions — are larger and have fewer defects.

The PCAM will grow crystals using the vapor diffusion method, which has been highly effective in previous Shuttle experiments. In vapor diffusion, liquid evaporates from a protein solution and is absorbed by a reservoir solution contained in a wicking material. As the protein concentration rises, the proteins form crystals.

A controlled-temperature enclosure occupying a single Shuttle mid-deck locker, called the Single-locker Thermal Enclosure System (STES), will hold six cylinders containing a total of 378 samples — one of the largest quantities in any single protein crystal growth experiment to date. In previous experiments of this type, a single locker accommodated a maximum of 60 samples. The STES will maintain temperatures at 72 degrees Fahrenheit (22 degrees Celsius).

Each cylinder contains nine trays held in position by guide rods and separated from each other by bumper plates with springs. The trays are sealed by an adhesive elastomer. Each tray holds seven sample wells, surrounded by a donut-shaped reservoir with a wicking material to absorb the protein carrier solution as it evaporates.

To start the experiment, an astronaut will open the front of the thermal enclosure, then rotate a shaft on the end of the cylinder with a ratchet from an Orbiter tool kit. This will allow diffusion to start and protein crystal growth to begin. Near the end of the mission, an astronaut will rotate the shaft in the opposite direction to stop diffusion.

A few of the candidate proteins for this flight of the PCAM are human cytomegalovirus assemblin (a factor in virus duplication), parathyroid hormone antagonist (a controlling factor in bone growth), pseudoknot 26 (a potential HIV inhibitor), and human antithrombin III (a blood clotting factor).

Dr. Daniel Carter of NASA's Marshall Space Flight Center, Huntsville, AL, is Principal Investigator for PCAM.

Space Acceleration Measurement System (SAMS)

STS-63 will be the 13th mission SAMS has supported and will be the third on a Spacehab mission. For this mission, SAMS will be flying in the mid-deck instead of the Spacehab module as it has in the past. SAMS will be supporting three different protein crystal experiments (PCG-STES, CPCG-VDA and PCF-LST). These experiments require late access for launch which can only be accommodated in the mid-deck of the Space Shuttle. Each of these experiments will have a dedicated 10 Hz triaxial sensor head (TSH) to monitor its particular vibration environment. Shortly before activation, the crew will mount the three TSHs at their designated locations close to the experiments.

SAMS will provide the scientists conducting these experiments with the information of the microgravity environment they experienced during the mission. The scientists will be able to account for the rocket thruster firings, crew activity and background vibrations that influence these delicate experiments. The instrument is managed by NASA's Lewis Research Center, Cleveland, OH, for the agency's Office of Life and Microgravity Sciences and Applications, Washington, DC.

Three-Dimensional Microgravity Accelerometer (3-DMA)

The Consortium for Materials in Space (CMDS) is sponsoring the Three Dimensional Microgravity Accelerometer on the STS-63 mission. The CMDS is a NASA Center for the Commercial Development of Space (CCDS) based at the University of Alabama in Huntsville (UAH).

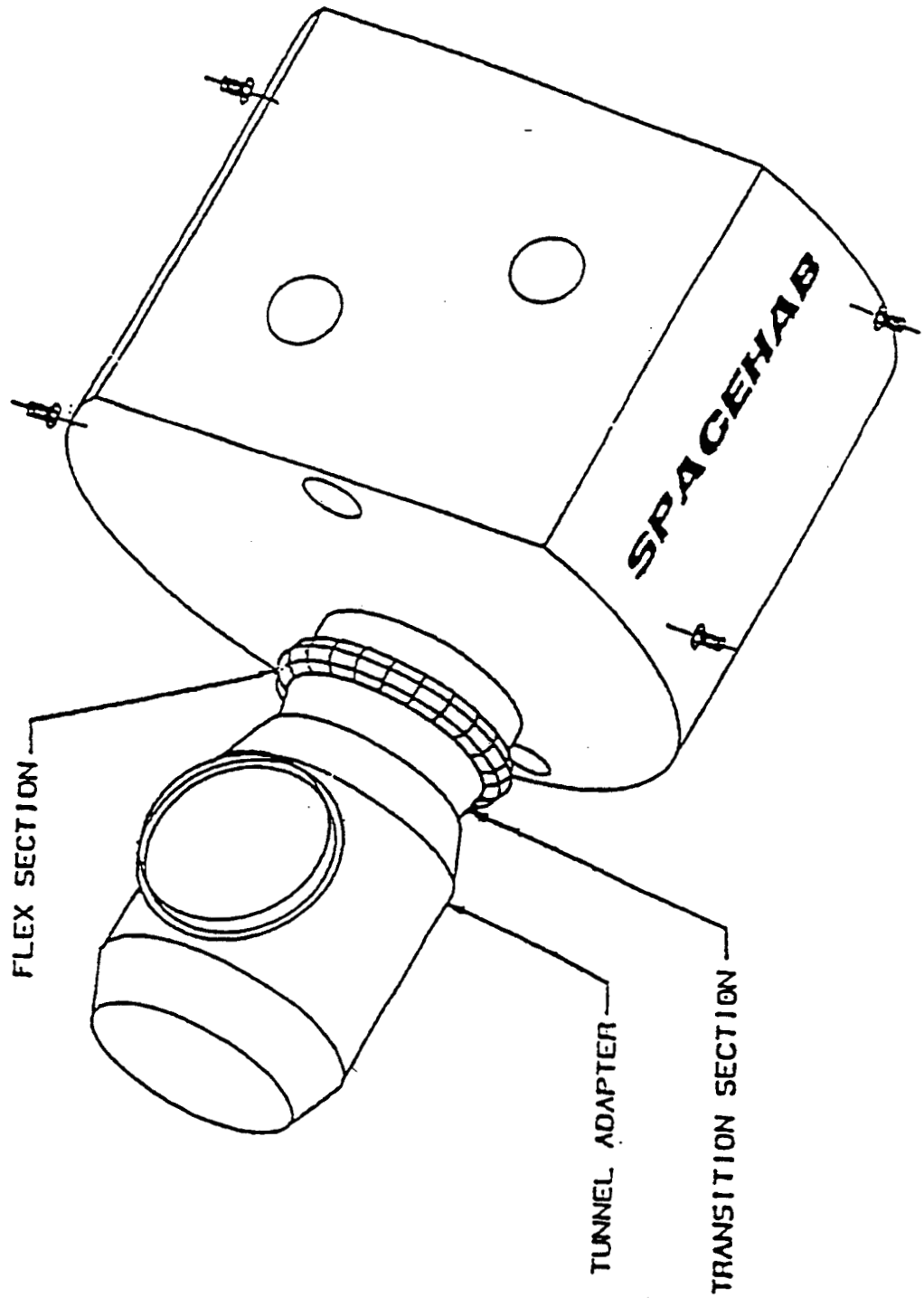
The acceleration measurement experiment system will help chart the effects of deviations from zero-gravity on experiments conducted in space. The microgravity environment inside the SPACEHAB Space Research Laboratory will be measured in the three dimensions by the 3-DMA at four different locations, allowing researchers to review experiment results against deviations from zero-gravity. This information will be used to determine the degree of microgravity achieved inside the SPACEHAB.

The 3-DMA will measure disturbances caused by operating various experiments in SPACEHAB and the residual microgravity resulting from Orbiter rotational motions and by residual resistance at the upper atmosphere fringes. No crew interaction is required on-orbit other than occasional status checks. Status data also are sent to the ground by telemetry.

The 3-DMA, which successfully flew aboard the first two SPACEHAB missions, has been developed as a low-cost system suitable for commercialization by the CMDS.

A potential application of 3-DMA would be to characterize potential microgravity environment of the International Space Station in support of experiments, research and commercialization activities.

Principal Investigator for 3-DMA is Jan Bijvoet of the UAH CCDS.

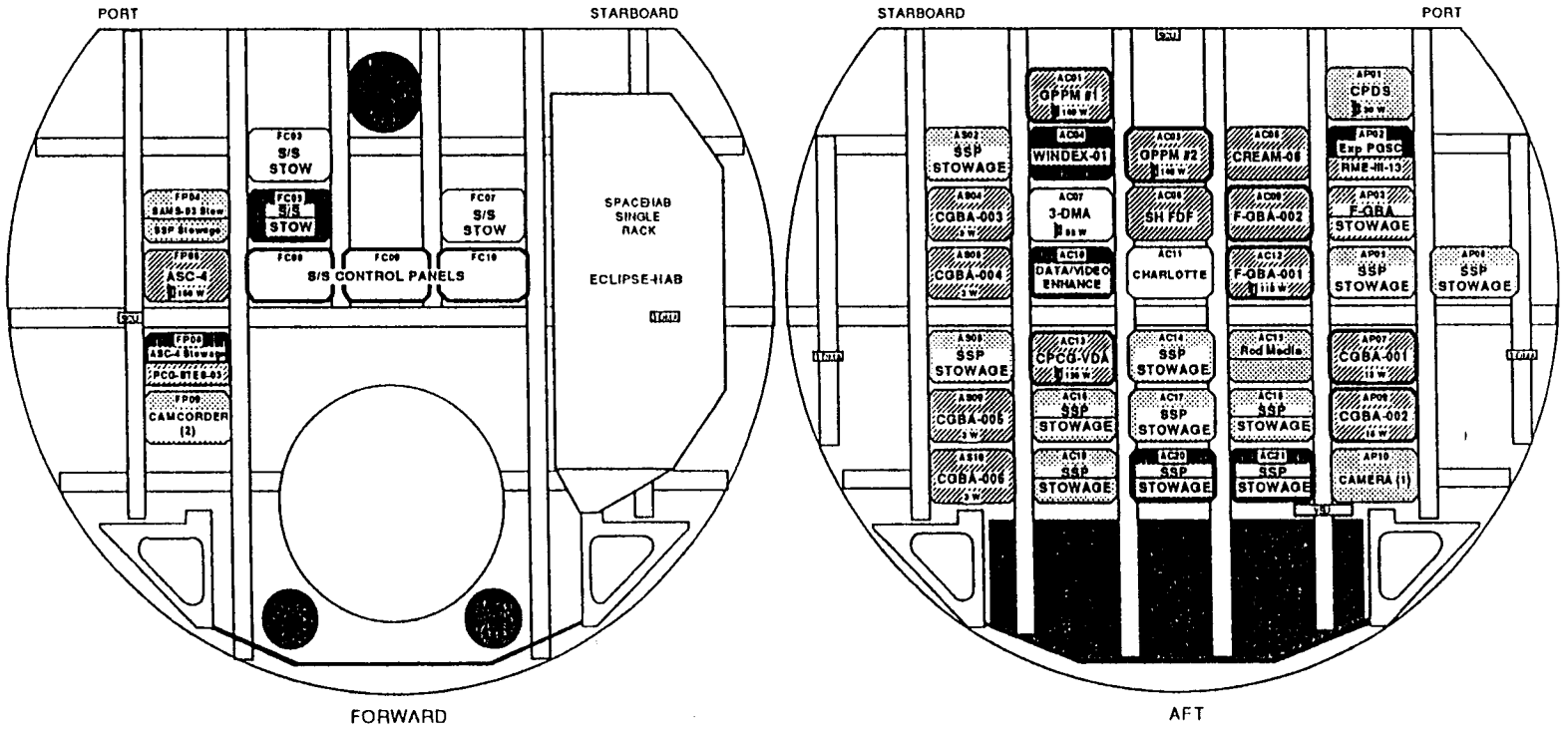


SPACEHAB - 3

SPACEHAB 03 EXPERIMENT OVERVIEW

SH-03 EXPERIMENT LAYOUT

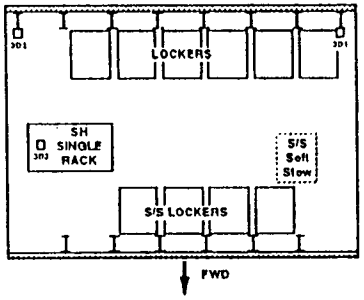
SPACEHAB 03 MODULE LAYOUT

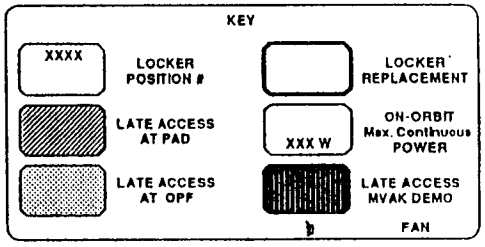


NOTES: The following are located in Orbiter Middeck during Ascent:

• BPL-03	(1 Locker)
• BRIC-03	(1 Locker)
• CHROMEX-06	(1 Unit)
• IMMUNE-02	(2 CAEMs)
• NIH-C-03	(1 Locker)
• PCF-LST	(1 CRIM)
• PCG-STES-03	(1 STES)
• CPCG-VDA	(1 CRIM)
• SAMS-03	(1 Unit)
• CPCG/PCF Access	(1 Locker)
• Camcorder (1)	(0.5 Locker)

CREAM-06 large tray transferred to Orbiter Middeck for Descent





10/27/94

SOLID SURFACE COMBUSTION EXPERIMENT

Principal Investigator: Robert A. Altenkirch, Dean of Engineering
Mississippi State University

The Solid Surface Combustion Experiment (SSCE) is a major study of how flames spread in a microgravity environment. Comparing data on how flames spread in microgravity with knowledge of how flames spread on Earth may contribute to improvements in all types of fire safety and control equipment. This will be the eighth time SSCE has flown aboard the Shuttle, testing the combustion of different materials under different atmospheric conditions. The experiment hardware is flown in the Shuttle mid-deck in place of the four middeck stowage lockers.

In the SSCE test planned for STS-63, scientists will investigate flame spread along a sample of plexiglas in an environment of 50% oxygen and 50% nitrogen at 1 atmosphere pressure. This flight will be the third test with the plexiglas fuel. The previous tests were performed on STS-54 with an environment of 70% oxygen and 30% nitrogen at 1 atmosphere and STS-64 with an environment of 50% oxygen and 50% nitrogen at 2 atmospheres.

Scientists will use computer image enhancement techniques to analyze the film record of the Solid Surface Combustion Experiment. They will then compare the enhanced images and recorded temperature and pressure data with a computer simulation of the flame spreading process. Reconciliation of data and predictions is expected to provide new insights into the basic process of combustion of solid surfaces. The data from the previous missions are still being analyzed but have already provided insights into the combustion process and improvements to the combustion model that the principal investigators have developed.

The experiment is sponsored by NASA's Office of Life and Microgravity Sciences and Applications and managed by NASA's Lewis Research Center, Cleveland, OH.

AIR FORCE MAUI OPTICAL SITE (AMOS)

The Air Force Maui Optical System (AMOS) is an electrical-optical facility on the Hawaiian island of Maui. No hardware is required aboard Discovery to support the experimental observations. The AMOS facility tracks the Orbiter as it flies over the area and records signatures from thruster firings, water dumps or the phenomena of "Shuttle glow," a well-documented fluorescent effect created as the Shuttle interacts with atomic oxygen in Earth orbit. The information obtained by AMOS is used to calibrate the infrared and optical sensors at the facility. AMOS is a Department of Defense payload and is flown under the direction of the DOD Space Test Program.

STS-63 CREW BIOGRAPHIES

James (Jim) D. Wetherbee, 42, Commander, USN, will be the Commander (CDR) of STS-63. Wetherbee was born in Flushing, NY, and will be making his third space flight.

Wetherbee graduated from Holy Family Diocesan High School in South Huntington, NY, in 1970; received a bachelor of science degree in aerospace engineering from the University of Notre Dame in 1974; and completed training at the U.S. Naval Test Pilot School in Patuxtent River, MD, in 1981.

His first Shuttle flight was as pilot of Columbia during STS-32, a mission that successfully deployed the Syncom IV-F5 satellite and retrieved the Long Duration Exposure Facility. He next flew as commander of STS-52, a mission that deployed the Laser Geodynamic Satellite and operated the first U.S. Microgravity Payload.

Wetherbee has logged more than 497 hours in space and more than 4,200 hours flying time and 345 carrier landings in 20 different types of aircraft.

Eileen M. Collins, 38, Lt. Col., USAF, will serve as Pilot (PLT). Born in Elmira, NY, Collins was selected as an astronaut in 1990. She will be making her first space flight, becoming the first woman to pilot a Space Shuttle.

Collins graduated from Elmira Free Academy, Elmira, NY, in 1974; received an associate of science degree in mathematics/science from Corning Community College in 1976; a bachelor of arts degree in mathematics and economics from Syracuse University in 1978; a master of science degree in operations research from Stanford University in 1986; and a master of arts degree in space systems management from Webster University in 1989. She is a 1990 graduate of the Air Force Test Pilot School.

She served as a T-38 instructor pilot and C-141 aircraft commander and instructor pilot. Collins has logged more than 4,000 hours in 30 different types of aircraft.

Bernard A. Harris Jr., 38, will be Payload Commander, Mission Specialist 1 (MS1) and Extravehicular Crewman 2 (EV2) on STS-63. Harris was born in Temple, TX, and will be making his second space flight.

Harris graduated from Sam Houston High School, San Antonio, TX, in 1974; received a bachelor of science degree in biology from the University of Houston in 1978; and a doctorate in medicine from Texas Tech University School of Medicine in 1982. After completing residency training in internal medicine at the Mayo Clinic, Harris conducted research in the field of musculoskeletal physiology and disuse osteoporosis under a Research Council Fellowship at the Ames Research Center, Moffett Field, CA.

Harris' first Shuttle flight was as a mission specialist on board Columbia during STS-55 in 1993. That mission saw a variety of research done in physical and life sciences. Harris has logged over 239 hours in space.

C. Michael (Mike) Foale, 38, will be Mission Specialist 2 (MS2) and Extravehicular Crewman 1 (EV1) on STS-63. Selected as an astronaut in 1987, Foale was born in Louth, England, but considers Cambridge, England, to be his hometown. Foale will be making his third space flight.

Foale graduated from Kings School, Canterbury, in 1975; received a bachelor of arts degree in physics, National Science Tripos, with first class honors from Queens College in 1978; and a doctorate in laboratory astrophysics from Cambridge University in 1982.

Foale's first flight was as a mission specialist on STS-45 in March and April, 1992, a mission that saw the first of the ATLAS flights to study the atmosphere and its interaction with the Sun. He also flew as a mission specialist on STS-56, carrying the ATLAS-2 and the SPARTAN retrievable satellite which made observations of the solar corona. Foale has logged more than 436 hours in space.

Janice Voss, 38, will be Mission Specialist 3 (MS3) on STS-66. Born in South Bend, IN, Voss considers Rockford, IL, her home town. She was selected as an astronaut in 1990 and will be making her second Shuttle flight.

Voss graduated from Minnechaug Regional High School, Wilbraham, MA, in 1972; received a bachelor of science degree in engineering science from Purdue University in 1975; a master of science degree in electrical engineering and a doctorate in aeronautics/astronautics from Massachusetts Institute of Technology in 1977 and 1987, respectively.

Voss' first Shuttle flight was as a mission specialist on STS-57 in June 1993. STS-57 included the retrieval of the European Retrievable Carrier (EURECA) satellite, and the first flight of the Spacehab mid-deck module. Voss has logged more than 239 hours in space.

Vladimir Georgievich Titov, 48, Colonel, Russian Air Force, will be Mission Specialist 4 (MS4) on STS-63. Titov will be making his first flight on board the Space Shuttle, becoming the second cosmonaut to fly on an American spacecraft.

In October 1992, Titov was one of two Russian cosmonauts named by the Russian Space Agency for mission specialist training. Titov trained as back-up mission specialist for Sergei Krikalev, who flew on STS-60 in February 1994.

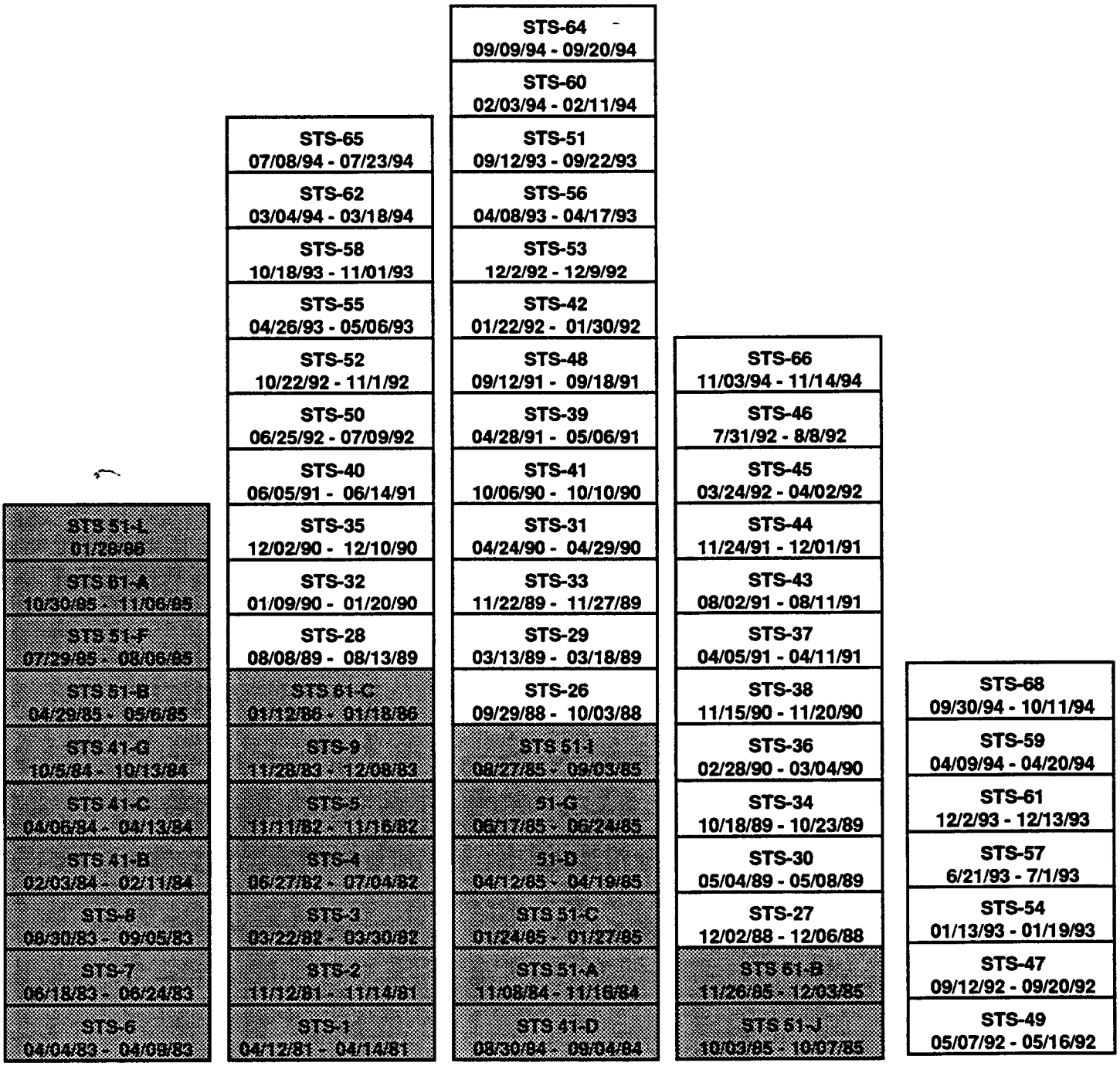
Titov graduated from the Higher Air Force College in Chernigov, Ukraine, in 1970 and the Yuri Gagarin Air Force Academy in 1987. He joined the cosmonaut team in 1976 and is a veteran of three space flights with a total of 368 days in space.

Titov served as commander on Soyuz T-8 and Soyuz T-10 in 1983 and Soyuz TM-4 in 1987. Soyuz T-8, a mission to repair a faulty Salyut 7 solar array, lasted 2 days, 17 minutes and 48 seconds when the rendezvous was aborted. Soyuz T-10 was aborted following a launch pad fire. The crew module was pulled clear of the rocket by the launch escape system and after a flight of 5 minutes, 30 seconds, landed 2.5 miles from the launch vehicle.

During his third space flight in December 1987, Titov rendezvoused with the Mir Space Station spending a record 365 days, 22 hours, 39 minutes in space.

SHUTTLE FLIGHTS AS OF DECEMBER 1994

66 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 41 SINCE RETURN TO FLIGHT



UPCOMING SHUTTLE MISSIONS

MISSION	TARGET DATE MISSION DURATION	ORBITER	MAJOR PAYLOADS AND/OR MISSION ACTIVITIES	CREW
STS-67	March 1995 16 Days	ENDEAVOUR	o ASTRO-2	CDR: OSWALD PLT: GREGORY MS: JERNIGAN MS: GRUNSFELD MS: LAWRENCE PS: PARISE PS: DURRANCE
STS-71	June 1995 10+1 Days	ATLANTIS	o Shuttle-Mir Mission-1	CDR: GIBSON PLT: PRECOURT MS: BAKER MS: HARBAUGH MS: DUNBAR MS: SOLOVYEV MS: BUDARIN
STS-70	June 1995 8 Days	DISCOVERY	o Tracking Data Relay Satellite System-G (TDRS-G) o ITEPC	CDR: HENRICKS PLT: KREGEL MS: SHERLOCK MS: THOMAS MS: WEBER
STS-69	July 1995 11 Days	ENDEAVOUR	o SPARTAN-201 o Wake Shield Facility-2 o IEH o ITEPC	CDR: WALKER PLT: COCKRELL MS: VOSS MS: NEWMAN MS: GERNHARDT

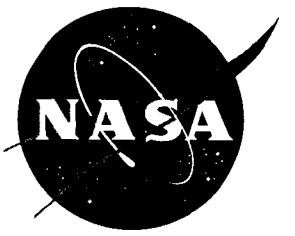
UPCOMING SHUTTLE MISSIONS

MISSION	TARGET DATE MISSION DURATION	ORBITER	MAJOR PAYLOADS AND/OR MISSION ACTIVITIES	CREW
STS-73	September 1995 16 Days	COLUMBIA	o United States Microgravity Laboratory-2 (USML-2) o OARE	CDR: BOWERSOX PLT: ROMINGER MS: THORNTON MS: COLEMAN MS: LOPEZ-ALGERIA PS: LESLIE PS: SACCO
STS-74	October 1995 6 +1 Days	ATLANTIS	o Shuttle-Mir Mission-2	CDR: CAMERON PLT: HALSELL MS: ROSS MS: MCARTHUR MS: HADFIELD
STS-72	November 1995 10 Days	ENDEAVOUR	o Space Flyer Unit - Retrieval o OAST-FLYER o SSBUV o LACIE	CDR: DUFFY PLT: JETT MS: CHIAO MS: BARRY MS: SCOTT MS: WAKATA
STS-75	February 1996 13 Days	COLUMBIA	o Tethered Satellite System-2 o United States Microgravity Payload-3 (USMP-3)	CDR: TBD PLT: TBD MS: CHANG-DIAZ MS: TBD MS: TBD PS: GUIDONI

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600



Mark Hess
Headquarters, Washington, DC
(Phone: 202/358-1776)

Doug Ward
Johnson Space Center, Houston
(Phone: 713/244-7926)

For Release

January 20, 1995

RELEASE: 95-6

NASA SIGNS LEASE/PURCHASE PACT FOR CLEAR LAKE DEVELOPMENT FACILITY

NASA today signed a firm, fixed-price $34 million lease/purchase agreement with the McDonnell Douglas Corporation to acquire real estate and facilities at the Clear Lake Development Facility, near the Johnson Space Center (JSC), Houston, TX.

Under terms of the contract, McDonnell Douglas will turn over to NASA a group of three large, modern industrial buildings and surrounding property and will build the Neutral Buoyancy Laboratory (NBL) in one of the buildings. These facilities will be leased by NASA until authority to complete actual acquisition is secured from Congress.

In addition to providing Shuttle operations training, NASA needs the NBL to train astronauts for Space Station assembly, which will involve the most extensive and complex EVAs ever attempted. Since existing weightless environment training facilities are inadequate to meet future extravehicular activities (EVA) training requirements, NASA developed plans to build the NBL.

The existing 101,000 square foot Assembly and Test Building will house a 101-foot wide by 202-foot long water tank, 40 feet deep, where astronauts will simulate spacewalks such as those required to service the Hubble Space Telescope or assemble the 831,000 pound Space Station. Segments of the Space Station will be delivered to orbit beginning in November 1997 on U.S. Space Shuttles, Russian and European launch vehicles and assembled in space by astronauts.

"This arrangement has numerous advantages," said Wilbur Trafton, Space Station Director. "It increases our confidence of delivering the NBL on schedule and on cost and it will be available earlier so that important training can begin." Trafton added that avionics facilities will be co-located with the NBL to increase program efficiency.

-more-

NASA had planned to build the NBL on site at JSC. Under this new agreement, McDonnell Douglas will construct the NBL off site in the 101,000 square foot Assembly and Test Building and will deliver the NBL at least six months earlier than previously planned, allowing training not otherwise possible for early Space Station flights. Construction of the new facility will eliminate expensive dual shift training operations at JSC and the Marshall Space Flight Center, Huntsville, AL. The agreement also will produce additional savings from the early shut down of JSC's existing underwater training facility. The building that will house the NBL also is large enough to carry out more concurrent activities, increasing training efficiency.

NASA will use the two other buildings - the 97,000 square foot Light Manufacturing Facility (LMF) and the 51,000 square foot Avionics Development Facility (ADF) -- for laboratory, technical support facilities and office space in excess of existing onsite and leased space. NASA will build, modify and store training mockups in the LMF. The ADF will provide contiguous laboratory space for avionics equipment and associated software development, integration and test activities.

Under the agreement, NASA also will acquire the 13-acre property surrounding the Clear Lake Development Facility including a parking lot and private access to Ellington Field.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

Contract Announcement

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Ernie J. Shannon
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-5565)

Brian Dunbar
Headquarters, Washington, DC
(Phone: 202/358-0873)

For Release
January 23, 1995

RELEASE: C95-a

RALPH M. PARSONS CO. SELECTED TO NEGOTIATE CONTRACT

NASA has selected the Ralph M. Parsons Co., Washington, DC, to negotiate a contract to provide architectural, engineering and other services to support new facilities for the Goddard Space Flight Center, Greenbelt, MD.

The five-year cost-plus-award-fee contract, proposed for $27 million, also will provide facilities engineering and technical services in support of Goddard's Facilities Management Division. The contract period will be from March 1995 through February 2000.

Proposals also were submitted by Allied Signal Technical Services Corp., Columbia, MD; Daniel, Mann, Johnson and Mendenhall, Washington, DC; and E.L. Hamm and Associates, Inc., Norfolk, VA.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

January 23, 1995

VIDEO ADVISORY: V95-3

SPACE STATION, HISTORIC RUSSIAN CREW ESCAPE ON NASA TV JAN. 24

NASA Television will provide video animations of the international Space Station, footage of the hardware which will allow the Space Shuttle Atlantis to dock with the Russian Mir space station, and historic footage of Cosmonaut Vladimir Titov successfully using a crew escape system during the explosion of Soyuz TM-10 in September 1983. Titov, who will fly aboard the upcoming STS-63 mission, is shown surviving the launch abort in historic footage provided by the Russian Space Agency.

ITEM #1:	*Animation of the Space Station*	TRT: 1:33
ITEM #2:	*Shuttle/Mir Docking Hardware*	TRT: 4:15
ITEM #3:	*Titov during Sept. '83 Soyuz rocket abort*	TRT: 2:29
ITEM #4:	*Discovery/Mir rendezvous animation*	TRT: 2:00
ITEM #5:	*Mir space station animation*	TRT: 3:19
ITEM #6:	*STS-63 Pilot Eileen Collins, Expanded Interview*	TRT: 37:00

Combined TRT: approximately 55 minutes. Transmission times: 12pm, 3pm, 6pm and 9pm EST.

Public Affairs Contacts:

International Space Station Program:	Mark Hess, 202/358-1778
U.S.-Russian Space Agency Cooperation:	Debra Rahn, 202/358-1639
Cosmonaut Titov Biographical Information:	Kyle Herring, 713/483-5111

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

January 24, 1995

Brian Dunbar
Headquarters, Washington, DC
(Phone: 202/358-0873)

Mary Hardin
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE: 95-7

TOPEX/POSEIDON CONFIRMS EL NINO IS BACK AND STRONGER THAN IN 1993

The El Nino phenomenon is back and is getting stronger, according to scientists studying data from the ocean-observing TOPEX/POSEIDON satellite.

El Nino is a climatic event that can bring devastating weather to several parts of the world, including the recent heavy rains and flooding in California, and the warmer than normal winter in the eastern United States.

"The satellite has observed high sea-surface elevation, which reflects an excessive amount of unusually warm water in the upper ocean," said Dr. Lee-Lveng Fu, JPL TOPEX/POSEIDON project scientist at NASA's Jet Propulsion Laboratory, Pasadena, CA. "The associated excess of heat creates high sea-surface temperatures, which affect the weather worldwide by heating the atmosphere and altering the atmospheric jet streams."

Jet streams are high-level winds, five to ten miles above the Earth's surface, created when warm and cold air masses meet. Shifts in the location of jet streams change temperatures and precipitation zones at the surface.

El Nino begins when the westward trade winds weaken and a large warm water mass, called a Kelvin wave, is allowed to move eastward along the equator in the Pacific Ocean. Data from the radar altimeter onboard TOPEX/POSEIDON, recorded from October through December 1994, reveal a new Kelvin wave moving toward the western coast of South America.

-more-

"This wave is currently occupying most of the tropical Pacific Ocean. It will take another month or two before the wave disperses. Compared to the El Nino condition of the winter of 1992-93, the present one appears somewhat stronger and might have stronger and longer lasting effects," Fu said.

TOPEX/POSEIDON, a joint program of NASA and the Centre Nationale d'Etudes Spatiales, the French space agency, uses a radar altimeter to precisely measure sea-surface height. Scientists use the TOPEX/POSEIDON data to produce global maps of ocean circulation. Launched Aug. 10, 1992, the satellite has completed two and a half years of its three-year prime mission and has provided oceanographers with unprecedented global sea level measurements that are accurate to better than 2 inches (5 centimeters).

"The global sea-surface elevation information provided by TOPEX/POSEIDON is unique because it is related to the amount of heat stored in the upper ocean, which is important for long-range weather forecasting. The speed and direction of ocean currents also can be determined from the elevation information, providing another piece of critical information about the ocean, which is the key to climate change," Fu continued.

TOPEX/POSEIDON is part of NASA's Mission to Planet Earth, a coordinated, long-term research program to study the Earth's global environment. TOPEX/POSEIDON's sea-surface height data are essential to understanding the role oceans play in regulating global climate, one of the least understood areas of climate research. TOPEX/POSEIDON will provide the first comprehensive, consistent measurements of the circulations of the ocean.

The Jet Propulsion Laboratory manages the TOPEX/POSEIDON mission for NASA.

-end-

Internet Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

January 25, 1995

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

INTERNET ADVISORY: I95-1

STS-63, DISCOVERY/MIR RENDEZVOUS PRESS KIT AVAILABLE VIA INTERNET

The press kit for STS-63, Space Shuttle Discovery's historic mission to rendezvous with the Russian Mir space station, is available to the public at the NASA Headquarters Public Affairs World Wide Web Homepage and FTP site.

During the STS-63 mission, due to launch Feb. 2, Discovery will fly within close proximity of the Russian space station Mir, in preparation for a Shuttle/Mir docking mission due to take place later this year. Primary payloads aboard Discovery will include the commercial SPACEHAB module on its third flight inside a Shuttle cargo bay, and the free-flyer Spartan-204 astronomy satellite.

NASA news release "95-5_STS-63_press_kit.txt," is available over the Internet using Fetch or similar software at:

FTP.HQ.NASA.GOV
in the PUB/PAO/PRESSKIT/1995 directory as 95-5_STS-63_press_kit.txt

or via Mosaic and the World Wide Web at the Headquarters Newsroom Homepage at URL:

http://www.nasa.gov/hqpao/newsroom.html

in the Press Kit folder as "95-5_STS-63_press_kit.txt"

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to 202)/358-4043. Press releases and other information are also available via FTP at: FTP.HQ.NASA.GOV in the PUB/PAO directory.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

January 26, 1995

Linda Dukes-Campbell
Lewis Research Center, Cleveland, OH
(Phone: 216/433-8920)

Don Nolan
Dryden Flight Research Center, Edwards, CA
(Phone: 805/258-3447)

Jim Doyle
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE: 95-8

NASA TO DEDICATE NEW FUEL CELL DEVELOPMENT TESTBED

NASA officials will dedicate a new testbed at Edwards Air Force Base in California's Mojave Desert on Jan. 31 for development of a solar-powered regenerative fuel cell system that will one day provide clean and efficient renewable electric power.

Officials from NASA Headquarters, the Lewis Research Center Cleveland, OH, and the Jet Propulsion Laboratory (JPL) Pasadena, CA, will dedicate the recently refurbished facility.

The dedication ceremony will begin at 10 a.m. PST at the Dryden Flight Research Center Auditorium and will be led by Donald Campbell, Director of the Lewis Research Center. The new testbed site is just north of Dryden. Attendees will be transported between the two sites via an experimental fuel cell bus.

Campbell said the new testbed is the heart of the Lewis Research Center's new government and industry multi-use regenerative fuel cell program and mirrors the administration's policy of developing technologies that will both foster U.S. competitiveness and, at the same time, support government programs.

-more-

A regenerative fuel cell system consists of a fuel cell, an electrolyzer and a photovoltaic solar array. The fuel cell directly converts hydrogen fuel and oxygen into electricity and water with no burning of the fuel. The electricity produced is supplied to the users. The water produced is stored and then regenerated back into hydrogen and oxygen by means of the solar-powered electrolyzer. A regenerative fuel cell system consumes sunlight and, because it is regenerative, is able to produce electricity both day and night.

Dr. Marvin Warshay, chief of the Electrochemical Technology Branch at Lewis Research Center, said regenerative fuel cell programs are good examples of multi-use programs which have obvious public benefits and will improve jobs in the United States. In the greater Cleveland area, several area industries are already in line to participate in the program and share part of the commercial benefits.

The multi-use regenerative fuel cell programs are being led by Lewis with JPL as an active member of the Lewis fuel cell team.

Among the many applications foreseen by officials of the program are clean and efficient electric cars, buses and locomotives. The systems also could provide communities with a cleaner and much less expensive means of power distribution. In future years regenerative fuel cell systems and their component technologies could be used for on-site generation of hydrogen and oxygen for chemical processing plants and as a stand-alone in remote locations.

-end-

NOTE TO EDITORS: News media wishing to attend the dedication ceremonies should contact Donald Nolan at the Dryden Flight Research Center, 805-258-3447, for directions and further information.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Mark Hess/Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

January 27, 1995

Kyle Herring
Johnson Space Center, Houston
(Phone: 713/483-5111)

RELEASE: 95-9

SPACE SHUTTLE CREW SELECTED FOR TETHERED SATELLITE MISSION

Marine Corps Lt. Col. Andrew M. Allen will command Space Shuttle Columbia's STS-75 mission in early 1996 -- the second flight of the Tethered Satellite System (TSS). This flight also marks the third devoted to orbital investigations using the United States Microgravity Payload (USMP).

Joining Allen are Air Force Major Scott J. Horowitz, pilot; payload commander Franklin R. Chang-Diaz, Ph.D; Italian Space Agency (ASI) TSS payload specialist Umberto Guidoni, Ph.D; mission specialist Jeffrey A. Hoffman, Ph.D; and European Space Agency mission specialists Claude Nicollier from Switzerland and Maurizio Cheli from Italy. Chang-Diaz and Guidoni were named to the crew in August and October 1994, respectively. Four of the seven crew members flew on STS-46 in July/August 1992 -- the first TSS mission during which the satellite was deployed to a distance of about 900 feet (274 meters) from the Shuttle.

The TSS project is a joint NASA/ASI effort managed by the Marshall Space Flight Center, Huntsville, AL. On STS-75, the five-foot diameter (1.6 meter) Italian-built satellite is scheduled to be deployed on the end of a 13-mile long (20 kilometer) conductive tether to study the electrodynamic effects of moving such a tether through the Earth's magnetic field. The experiment also will test techniques for managing the tethered spacecraft at great distances.

Throughout the 13-day flight, additional experiments housed in the Orbiter's payload bay will permit scientists access to space for microgravity and fundamental science investigations. The USMP is designed to provide the foundation for advanced scientific investigations similar to those planned aboard the international Space Station.

- more -

Allen, 39, flew on STS-46 and on STS-62 in March 1994. He received a bachelor of science degree in mechanical engineering from Villanova University in 1977. Allen was born in Philadelphia, PA.

Horowitz, 37, is a member of the astronaut class of 1992 and will be making his first Shuttle flight. His master of science and doctorate degrees in aerospace engineering were earned from Georgia Institute of Technology in 1979 and 1982, respectively. While born in Philadelphia, he considers Thousand Oaks, CA, his hometown.

Chang-Diaz will be flying on his fifth Shuttle mission. He was a mission specialist on STS 61-C in January 1986, STS-34 in October 1989, STS-46, and STS-60 in February 1994. His doctorate in applied plasma physics from the Massachusetts Institute of Technology was awarded in 1977. Chang-Diaz, 44, was born in San Jose, Costa Rica.

Guidoni, 40, was born in Rome, Italy, and holds a bachelor of science degree in physics and a Ph.D. in astrophysics from the University of Rome. He was the alternate payload specialist on the first TSS flight and is a co-investigator on the Research on Electrodynamic Tether Effects (RETE) experiment scheduled during the mission. STS-75 will be his first Shuttle flight.

Hoffman, 50, will be making his fifth Shuttle flight. His previous space flight experience includes STS 51-D in April 1985, STS-35 in December 1990, STS-46 and STS-61 in December 1993. His doctorate in astrophysics was obtained from Harvard University in 1971. Hoffman was born in Brooklyn, NY, but considers Scarsdale, NY, his hometown.

Nicollier, 50, has flown twice previously on the Shuttle -- STS-46 and STS-61 in December 1993. He earned his master of science degree in astrophysics from the University of Geneva in 1975. Nicollier was born in Vevey, Switzerland.

Cheli, 35, is a member of the astronaut class of 1992 and will be making his first Shuttle flight. He studied geophysics at the University of Rome in 1989 and received a master of science in aerospace engineering from the University of Houston. Cheli was born in Modena, Italy.

- end -

NASA News

National Aeronautics and
Space Administration

Washington, D.C. 20546
202 358-1600

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Steve Roy
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/544-6535)

For Release
January 30, 1995

RELEASE: 95-10

NASA'S X-RAY TELESCOPE MIRRORS COMPLETED AHEAD OF SCHEDULE

A space-based observatory, under construction for NASA, has met an important milestone -- polishing and measurement of the observatory's eight mirrors, one of the project's toughest technical challenges, has been completed four months ahead of schedule at Hughes Danbury Optical Systems (HDOS), Danbury, CT.

Data from the observatory, called the Advanced X-ray Astrophysics Facility (AXAF), will be used to study X-ray radiation and is expected to significantly improve scientific understanding of some of the most energetic and violent processes in the universe. Launch of the AXAF is scheduled for September 1998.

The observatory will produce picture-like images and spectrograms which will yield information on temperature and chemical composition of the objects it observes. Among the objects that will be observed are neutron stars, black hole candidates, debris from supernova explosions, quasars, the centers of active galaxies and hot gas in individual galaxies and clusters of galaxies.

"The reason for this success was that we invested the time up front to understand the polishing and metrology process," said AXAF Telescope Project Manager John Humphreys. "The first mirror took nine lengthy polishing cycles to complete. We then applied a process of continual improvements to get the job done much faster and were able to complete the final mirror in only three polishing cycles."

Humphreys said a plan has been put into place to exploit these early deliveries and get a head start on the next set of challenges -- coating the mirrors with a reflective iridium layer.

The measurements of the just-completed mirrors indicate that the shape and smoothness meet the exacting program goals. Their average smoothness, measured at 3 Ångstroms, is the width of just three atoms. Certifying the accuracy of measurements on a scale this small proved to be a challenge for engineers.

-more-

"Fabrication required measurements so precise that there was no existing standard of reference in the world. In fact, the National Institute of Standards and Technology has expressed interest in using the technology developed for AXAF in a national facility for metrology," said Humphreys.

The most critical part of this mirror metrology process has been the independent measurements and cross-checks. Critical measurements were made using several techniques or pieces of equipment to rule out the possibility of a flaw in the measuring equipment itself. In addition, over 68 people from twelve separate organizations have participated in the review of AXAF mirror procedures, fabrication, metrology and test data.

The mirrors of AXAF's X-ray telescope are very different from those in optical telescopes. They are cylindrical in shape with inner surfaces finely polished to precise, mathematically determined, geometric shapes. X-rays enter the front of the telescope and reflect off of the inner surfaces of the mirrors at very shallow or grazing angles, almost like a stone skipping over water, finally coming to a focus behind the mirrors. The cylinder-like mirrors are used in pairs, with each pair "nested" inside the next larger set so that the frontal, energy-collecting area of the telescope is as large as possible. AXAF's mirror assembly holds four pairs of cylindrical mirrors.

AXAF will produce spectrographic information about the temperature and chemical composition of objects by separating the radiation received according to wavelength, much as a prism splits visible light into constituent colors. The observatory will produce 'picture-like' X-ray images analogous to images in visible light made by traditional telescopes. Once in orbit and operational, AXAF will provide scientists with the most detailed views of the universe ever obtained through observation of X-ray emissions.

The next step for AXAF is the precise alignment of the mirrors. The first and largest pair of mirrors currently are being aligned in a pathfinder mirror assembly at Eastman-Kodak Company (EKC), Rochester, NY. After completion of this pathfinder alignment effort, the mirrors will be shipped to Optical Coating Laboratory, Inc. (OCLI) in Santa Rosa, CA, where they will be coated with iridium, returned to Kodak, integrated and aligned into the High Resolution Mirror Assembly. The remaining six mirrors for AXAF also will be coated at OCLI and sent to EKC for assembly.

In 1996, all of the AXAF flight optics and detectors required to meet the science mission objectives will be aligned and tested in the X-ray Calibration Facility at Marshall.

AXAF is designed to be complementary to NASA's Great Observatories already in orbit -- the Hubble Space Telescope launched in 1990, and the Compton Gamma-Ray Observatory, launched in 1991. Each observatory makes observations of stars, galaxies, and other astronomical objects in distinct and separate wavelengths of energy, including visible light, ultraviolet, gamma rays, and, in the case of AXAF, X-rays.

The AXAF development team consists of NASA, the Smithsonian Astrophysical Observatory, TRW, HDOS, EKC and the Marshall Space Flight Center, which manages the project for NASA's Office of Space Science, Washington, DC

- end -

EDITOR'S NOTE: An artist's depiction of AXAF is available to news media representatives by calling the Broadcast & Imaging Branch on 202/358-1900.

Photo number is: Color: 95-HC-62
Black and White: 95-H-64

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Beth Schmid
Headquarters, Washington, DC
(Phone: 202/358-1760)

February 2, 1995

NOTE TO EDITORS: N95-5

NASA FY 1996 BUDGET BRIEFING SCHEDULED

A press briefing on NASA's fiscal year 1996 budget request will be held at 2 p.m. EST, Monday, Feb. 6, in the NASA Headquarters auditorium, 300 E Street SW, Washington, DC.

Administrator Daniel S. Goldin and other NASA officials will participate in the briefing and answer questions. A summary of the budget request will be distributed at the beginning of the briefing.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Brian Dunbar
Headquarters, Washington, DC
(Phone: 202/358-1547)

Ernie Shannon
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-8955)

For Release
February 2, 1995

RELEASE: 95-11

SUCCESSFUL U.S.-RUSSIAN OZONE-MONITORING MISSION APPEARS OVER

More than three years after it began, the mission of NASA's Total Ozone Mapping Spectrometer (TOMS) aboard the Russian Meteor-3 spacecraft appears to be over.

Recent attempts to revive the instrument, which failed in December, have been unsuccessful. Though monitoring of the device will continue through April, the instrument team has said it is unlikely that further efforts will succeed.

Launched from Plesetsk in the then-Soviet Union on Aug. 15, 1991, the TOMS instrument has already exceeded its design life of two years, providing important data and global maps of total ozone levels. TOMS data is used primarily to determine long-term ozone trends, detect sulfur dioxide clouds from volcanic eruptions and detect atmospheric aerosols and dust storms.

"Even though it appears we will lose the instrument, I am quite pleased with TOMS and the Russian spacecraft's performance during the past 3 years," said Dr. Jay Herman, TOMS/Meteor-3 principal investigator, of NASA's Goddard Space Flight Center, Greenbelt, MD. "The instrument has produced a large quantity of critical atmospheric data longer than its designed 2-year lifetime."

The TOMS/Meteor-3 instrument is NASA's second. The first, which operated from 1978 through 1993, provided part of the scientific underpinning for international treaties banning the manufacture and use of ozone-depleting chemicals.

No useful data have been received since Dec. 27, 1994, when spacecraft telemetry indicated a lack of steady electrical current to the instrument's chopper motor. The chopper divides, or "chops," incoming solar energy for measurements of ultraviolet radiation. The chopper reduces the amount of noise in the observed radiance data and improves the accuracy of the ozone determination. Recently, ground controllers in Russia successfully "warmed" the Meteor-3 spacecraft in hopes of recovering the instrument, but without results.

-more-

"We appreciate our Russian colleagues' efforts to help us try an innovative approach to spacecraft operations," Herman said. "This kind of cooperative spirit has marked all phases of the mission, from planning and operations to data analysis. The result has been a very smooth mission."

U.S. and Russian engineers will continue to monitor the instrument. A power cycling technique will be tried again in April, when the spacecraft's orbit will lead it to warm naturally. Members of the instrument team, however, believe the chance of reviving TOMS is very small.

NASA plans to fly two more TOMS within 13 months. The first is scheduled for launch aboard a Pegasus launch vehicle in May, the second aboard the Japanese Advanced Earth Observing Satellite in February 1996. The fifth TOMS instrument will fly aboard a Russian Meteor-3M satellite in 2000.

Even without an operational TOMS in orbit, ozone studies will continue. A network of ground stations and satellites, including NASA's Upper Atmosphere Research Satellite and Earth Radiation Budget Satellite and NOAA weather satellites, are still obtaining local, regional and some global ozone measurements.

"We will still be able to provide ozone data to scientists," Jack Kaye of NASA Headquarters, the TOMS program scientist, "but not with the high quality and spatial coverage of TOMS. This instrument is unique in its ability to provide highly accurate daily maps of ozone over the entire sunlit Earth. The loss of TOMS will particularly affect our ability to study details of ozone dynamics at high latitudes in the winter and early spring, when substantial ozone depletion can occur."

TOMS data are one of the most visible elements of NASA's Mission to Planet Earth, the Agency's long term, coordinated research effort to study the Earth's global environment. It is comprised of ground-based, airborne and space-based investigations into how the Earth's large environmental systems—air, water, land and life—interact and change, and how human activities contribute to those changes. Mission to Planet Earth data will be made available to scientists worldwide so that humans ultimately will be able to make informed decisions about how their activities will affect the environment.

The TOMS instrument is managed by the Goddard Space Flight Center for NASA's Office of Mission to Planet Earth, Washington, DC.

- end -

Internet Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

February 6, 1995

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

INTERNET ADVISORY: I95-2

NASA FY 1996 BUDGET BRIEFING PACKAGE AVAILABLE VIA INTERNET

The NASA FY 1996 budget request briefing package, presented to the press and the public today at 2 p.m. EST by NASA Administrator Daniel S. Goldin, is available via the Internet at the NASA Headquarters Public Affairs World Wide Web Hompage and FTP site.

The NASA budget briefing package is available over the Internet using Fetch or similar software at:

FTP.HQ.NASA.GOV

in the PUB/PAO/PRESSREL/1995 directory as **96budget.txt**

or via Mosaic and the World Wide Web at the Heardquarters Newsroom Homepage at URL:

http://www.nasa.gov/hqpao/newsroom.html

in the press release/1995 folder as **96budget.txt**

The full printed version of the NASA FY 1996 Budget Request can be purchased from the NASA Headquarters Information Center by calling 202/358-0000.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

February 5, 1995

VIDEO ADVISORY: V95-11

SPACE SHUTTLE DISCOVERY/MIR RENDEZVOUS ON NASA TV FEB. 6

NASA TV will provide coverage of the Space Shuttle Discovery/Mir Russian space station rendezvous scheduled for Feb. 6 as part of NTV continuing 24-hour mission coverage. The Shuttle/Mir rendezvous activities and times are listed below. All times are approximate and subject to change based on mission operations.

Live television feeds from cameras aboard Discovery and Mir will be aired as available. Discovery will begin the rendezvous sequence at approximately 11:37 a.m. EST. The first live television of Discovery and Mir at orbital sunrise will occur at approximately 2:15 p.m. EST. The rendezvous activities are expected to conclude at approximately 4:30 p.m. EST. A replay of Shuttle/Mir rendezvous highlights will be aired at 7 p.m. EST Monday.

The STS-63 Mission Status Briefing will air at 5:30 p.m. EST. At 8 p.m. EST, a replay of the NASA FY 1996 budget press conference from earlier Monday, featuring Administrator Daniel S. Goldin, will be aired.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

Real time mission updates and television scheduling information may be obtained by contacting the Johnson Space Center Newsroom at 713/483-5111.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Sarah Keegan
Headquarters, Washington, DC
(Phone: 202/358-1902)

February 7, 1995

NOTE TO EDITORS: N95-6

NASA ADMINISTRATOR'S SECOND SEMINAR SCHEDULED

"Living Places in Other Solar Systems," the second seminar in a series to help shape a unified agenda for the future of the nation's space program, will be held on Friday, Feb. 10, at 3 p.m. EST in the NASA Headquarters west lobby auditorium, 300 E St., SW, Washington, DC. Dr. Anneila Sargent, California Institute of Technology and Owens Valley Radio Observatory, and Dr. Christopher P. McKay, NASA Ames Research Center, will explore the topic of habitable planets outside our solar system and the ramifications of discovery of life on another cosmic body.

The seminar series, initiated by NASA Chief Scientist Dr. France Anne Cordova and introduced by NASA Administrator Daniel S. Goldin, will be scheduled over the next year and will consider fundamental questions that bear on NASA's greatest challenges.

Media representatives who wish to cover the event with cameras should notify (by 1 p.m. EST on Feb. 10) Sarah Keegan, NASA Public Affairs, 202/358-1902.

-end-

The first Seminar was scheduled for January 23, 1995 at 6:00 p.m., EST. The second one is scheduled for 3:00 p.m. Wonder if attendance had anything to do with the change in time?

LDS/ICH/2/8/95

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Brian Dunbar
Headquarters, Washington, DC
(Phone: 202/358-1547)

February 7, 1995

Mary Hardin
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE 95-12

SPACE RADAR STUDIES ARCHEOLOGICAL SITE IN CAMBODIA

Images from the international Space Radar Laboratory (SRL) may help researchers find previously unknown settlements near the ancient city of Angkor in Cambodia.

The radar data was obtained during the October flight of NASA's Space Shuttle Endeavour, processed and sent to the World Monuments Fund (WMF) in January. The group had approached the radar science team about observing the Angkor area after SRL's first flight in April 1994.

"I had read about the radar mission while the April flight was in progress and instantly surmised that it would have applications to the international research efforts at Angkor," said John Stubbs, program director for the fund. "I didn't really know where to start, but I was hopeful NASA would be willing to image the area around Angkor."

Angkor, a vast complex of more than 60 temples dating back to the ninth century A.D., served as the spiritual center for the Khmer people. At its height, the city housed an estimated population of one million people and was supported by a massive system of reservoirs and canals.

The April flight of SRL's complementary radars, the Spaceborne Imaging Radar-C/X-band Synthetic Aperture Radar (X-SAR), first demonstrated their capability to obtain vast amounts of data applicable to ecological, oceanographic, geologic and agricultural studies.

"We realized after the huge success of the first flight that we could be more flexible in adding new sites to the timeline of flight two," said Dr. Diane Evans, the SIR-C project scientist at NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA. "Since our science team was interested in studying as much of the tropical rain forest as possible, Cambodia and the Angkor site seemed to be a great complement to our ecology objectives."

-more-

Today, Angkor is hidden beneath a dense rain forest canopy. Its temples have been ravaged by weather, war and looters. Its extensive irrigation system has fallen into disuse.

"The radar's ability to penetrate clouds and vegetation makes it an ideal tool for studying Angkor," Stubbs said. "I can see the canal-and-reservoir system very clearly in the radar imagery, and preliminary analysis reveals what may be evidence of organized settlements of large tracts of land to the north of the present archeological park, which until now, has gone unnoticed."

The SIR-C/X-SAR data will be used by the WMF, the Royal Angkor Foundation and research teams from more than 11 countries to understand how the city grew and then fell into disuse over 800 years.

"The 'temple mountain' monuments at Angkor, such as Angkor Wat and the Bayon, are not unlike some of the pyramidal forms encountered in Central America," Stubbs said. "The sheer size and sophistication of Angkor's great city plan, now enveloped in dense jungle, sets this ancient capital apart as the ultimate jungle ruin."

SIR-C/X-SAR is a joint mission of the United States, German and Italian space agencies. JPL built and manages the SIR-C portion of the mission for NASA's Office of Mission to Planet Earth.

NOTE TO EDITORS: SIR-C/X-SAR radar images are available from JPL's public access computer site, via Internet and the World Wide Web, at the address http://www.jpl.nasa.gov, by anonymous file transfer protocol (ftp) at the address jplinfo.jpl.nasa.gov, or by dialup modem to the telephone number1- (818) 354-1333.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Terri Hudkins
Headquarters, Washington, DC
(Phone: 202/358-1977)

February 8, 1995

MEDIA ADVISORY

NASA/NAVY PARTNER WITH WASHINGTON COMMUNITY

NASA and the Naval District Washington (NDW) will sign a cooperative agreement to support national community service initiatives in the Washington area and the Hands-on-Science Project in the DC Public School System. The signing ceremony will be held Thursday, Feb. 9, at 10 a.m. EST, at Thaddeus Stevens Elementary School, 1050 21st St., N.W.

The Hands-on Science Project is designed to provide enrichment through classroom demonstration to third through sixth grade students. Five to eight NASA volunteers will team with high school student interns to present science demonstrations to students at Turner Elementary School of Washington on Wednesday afternoons. The Navy volunteers will serve at Stevens Elementary School on Tuesday afternoons.

Sam Armstrong, NASA Associate Administrator for Human Resources and Education and Rear Admiral Edward Moore, Jr., U.S. Navy Commandant, NDW, will participate in the ceremony. Also participating in the signing will be Juanita Braddock, Principal of Stevens Elementary School, and Tyrone Taylor, Director of NASA's National Service Office.

This project is the first of many planned between NASA and NDW. Through this arrangement, NASA will pursue future agreements with the Departments of Navy and Defense.

Hands-on-Science Outreach, Inc., Rockville, MD, a nonprofit organization, developed the science demonstrations.

- end -

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

For Release

February 8, 1995

VIDEO ADVISORY: V95-12

NASA TV TO SHOW FIRST AFRICAN AMERICAN WALKING IN SPACE TOMORROW

NASA TV will provide live coverage of a spacewalk by astronauts Dr. Bernard Harris, the first African American to walk in space, and Michael Foale, crewmembers aboard the Space Shuttle Discovery, starting at 6:42 a.m. EST Feb. 9. All times are approximate and subject to change based on mission operations.

As the Orbiter circles the Earth, it will travel in and out of television communication links, causing periodic interuption of spacewalk coverage. Due to rendezvous manuevers scheduled for early Thursday morning to retrieve the Spartan Astronomy satellite, exact Ku spacewalk feed times are not available. NTV feeds from cameras aboard Discovery will provide live views as available during the five-hour spacewalk. Astronauts will be testing recent modifications to the Shuttle spacesuit design and practice handling large objects in microgravity to help prepare for construction of the international Space Station.

During the extravehicular activity Foale will be designated as "EV1" wearing red stripes on the legs of his spacesuit, while Harris will be "EV2" with no stripes on his suit. Pilot Eileen Collins will assist the spacewalkers from inside the crew cabin, serving as primary communicator between the spacewalkers and Discovery's crew, while Russian cosmonaut Vladimir Titov will be the operator of the Shuttle's robot arm.

The STS-63 Mission Status Briefing will air at 1 p.m. EST, with the day's mission highlights played at 2:30 p.m. EST.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

Real time mission updates and television scheduling information may be obtained by contacting the Johnson Space Center Newsroom at 713/483-5111.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Mark Hess/Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

February 8, 1995

Doug Ward
Johnson Space Center, Houston
(Phone: 713/244-7926)

RELEASE: 95-13

NASA/RUSSIAN SPACE AGENCY REACH AGREEMENT ON KEY STATION ELEMENT

NASA and the Russian Space Agency (RSA) have signed a protocol complementing an agreement reached between Lockheed Missiles & Space Co. and Russia's State Research and Production Space Center (Khrunichev) for the U.S. purchase of the Russian Functional Energy Block (FGB). The FGB will be launched in November 1997 as the first element of the international Space Station.

The protocol, signed Feb. 5 in Houston by Randy Brinkley, NASA's Space Station Program Manager, and Boris D. Ostroumov, the Russian Space Agency's Deputy, Piloted Space Flight, reflects acceptance by the two space agencies of contract terms negotiated by Lockheed and Khrunichev.

The NASA/RSA protocol also guarantees, with no additional cost to NASA, the launch of the FGB on a Russian Proton booster, and navigational control in orbit and related engineering, integration, logistics, maintenance and training support for the FGB.

The Lockheed agreement with Khrunichev, a subcontract to NASA's prime Space Station contractor, Boeing, calls for the design, development, manufacturing, test and delivery of the FGB at a price of $190 million.

After initial use as a propulsion module, the FGB will serve as a fuel storage module and a service area, which will provide living and experimentation space as well as backup guidance, navigation and control. In addition, the FGB will serve as an integral part of the Space Station's overall power and information subsystems.

-more-

Under the agreement, Khrunichev will supply one flight-ready FGB. The agreement also calls for on-orbit operation and performance verification of the FGB, as well as transportation prior to launch between the Khrunichev production facility and the launch complex at Baikonur, Kazakhstan.

In a related agreement, NASA and the RSA on February 6 signed a protocol establishing a liaison office in Houston to support the U.S. - Russian human space flight program. NASA maintains a similar technical liaison office in Moscow.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

Internet Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

For Release

February 9, 1995

INTERNET ADVISORY: I95-3

CURRENT SPACE SHUTTLE MISSION IMAGES AVAILABLE OVER INTERNET

Over a dozen images from the current Space Shuttle Discovery mission are available to the public over the World Wide Web.

Images showing the dramatic night time lift off of Discovery, scenes of crewmenbers working in space, and photos of the Mir Space Station are available by linking to a NASA Public Affairs "Current NASA Mission" site. Images for this mission will be updated, and images of future NASA Shuttle missions will be placed at this site for access by the media and the public.

The URL for these images is:

http://www.hq.nasa.gov/office/pao/NewsRoom/today.html

The Headquarters Public Affairs Home Page, which provides general information about NASA with links to other Agency Web pages, can be accessed at URL:

http://www.nasa.gov/hqpao/hqpao_home.html

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to 202)/358-4043. Press releases and other information are also available via FTP at: FTP.HQ.NASA.GOV in the PUB/PAO directory.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

February 9, 1995

Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

Kari Fluegel
Johnson Space Center, Houston
(Phone: 713/483-5111)

NOTE TO EDITORS: N95-7

PRE-FLIGHT BRIEFINGS FOR ASTRO-2 MISSION SET FOR FEB. 16

Flight controllers, scientists and astronauts preparing for the second flight of the Astro Observatory will discuss the upcoming mission with media representatives during the STS-67 pre-flight briefings Feb. 16.

Scheduled to launch in early March, the Astro-2 mission will use three unique instruments -- the Hopkins Ultraviolet Telescope, the Ultraviolet Imaging Telescope and the Wisconsin Ultraviolet Photo-Polarimeter Experiment -- to collect ultraviolet measurements of the universe, supplementing data collected on the first Astro flight aboard the Space Shuttle in 1990.

The pre-flight briefings will originate from the Johnson Space Center (JSC) in Houston, and the Marshall Space Flight Center (MSFC), Huntsville, AL. Two-way question and answer capability will be available from other NASA Centers.

The briefing schedule is as follows: (All times are Eastern)

9 a.m. **Mission Overview (originating from JSC)**
Chuck Shaw, STS-67 Lead Flight Director
Dr. Robert Jayroe, Astro-2 Mission Manager, MSFC

10 a.m. **Astro-2 Science Briefing (originating from MSFC)**
Dr. Robert Stachnik, Astro-2 Program Scientist, NASA Headquarters
Dr. Charles Meegan, Astro-2 Mission Scientist, MSFC
Dr. Arthur Davidsen, HUT Principal Investigator, Johns Hopkins University, Baltimore, MD
Dr. Steve Maran, UIT Instrument Team, Goddard Space Flight Center, Greenbelt, MD
Dr. Arthur Code, WUPPE Principal Investigator, University of Wisconsin, Madison

-more-

11:30 a.m. MACE (originating from JSC)
Greg Stover, MACE Project Manager, Langley Research Center (LARC)
Dr. David Miller, MACE Co-Principal Investigator, LARC

2 p.m. STS-67 Astronaut Crew Briefing (originating from JSC)
Steve Oswald, Commander
Bill Gregory, Pilot
John Grunsfeld, Mission Specialist 1
Wendy Lawrence, Mission Specialist 2
Tammy Jernigan, Payload Commander, Mission Specialist 3
Sam Durrance, Payload Specialist 1
Ron Parise, Payload Specialist 2

NASA Television will carry all briefings live on Spacenet 2, Transponder 5, Channel 9 at 69 degrees West longitude. The transponder frequency is 3880 Mhz and the audio subcarrier is 6.8 Mhz. The polarization is horizontal.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

February 9, 1995

Michael Mewhinney
Ames Research Center, Moffett Field, CA
(Phone: 415/604-9000)

Keith Takahashi/Evelyn Smith
McDonnell-Douglas Aerospace, Huntington Beach, CA
(Phone: 714/896-1302/896-1700)

Mardie Lane
Hawaii Volcanoes National Park
(Phone: 808/967-7184

Susan Lendroth
The Planetary Society, Pasadena, CA
(Phone: 818/793-5100)

RELEASE: 95-14

NASA SCIENTISTS TO CONTROL RUSSIAN ROVER EXPLORING VOLCANO

From a laboratory in California, NASA scientists next week will drive a modified Russian planetary rover around the most active volcano on Earth.

Scientists at NASA's Ames Research Center, Moffett Field CA, will use Russia's modified Marsokhod rover to conduct field tests simulating remote-controlled exploration of the Moon and Mars from laboratories on Earth. Tests will be conducted Feb. 13-18 in Hawaii Volcanoes National Park on the Big Island of Hawaii.

The field tests are part of a cooperative effort involving McDonnell Douglas Aerospace, Arizona State University and the University of Hawaii. The tests were funded in part by NASA and cost approximately $400,000.

The tests also are being conducted in cooperation with The Planetary Society, the JASON Foundation for Education, the National Park Service, the U.S. Geological Survey, and Russia's Lavochkin Association, Institute for Space Research (IKI) and VNITTransMash, an organization of the Russian Space Agency.

-more-

The Marsokhod is capable of traversing both Martian and lunar terrain. The same Russian team that developed the successful Lunakhod rovers has been developing the Marsokhod for possible future missions to Mars. Its superior mobility also makes it suitable for more ambitious lunar investigations. It is equipped with six cone-shaped titanium wheels, each with its own drive motor, which enable it to climb over large boulders nearly 3 feet (90 centimeters) high. It also has a robotic arm built by McDonnell Douglas to retrieve objects and video cameras to transmit live stereo images.

"The combination of the Russian rover chassis with western avionics is an excellent example of the benefits that are possible from international cooperation," said John Garvey, project manager for the McDonnell Douglas team that is sponsoring the use of the Russian chassis for the activities in Hawaii.

"The rover takes advantage of new technologies from other programs like last year's Clementine mission to the Moon and NASA's upcoming Mars Pathfinder," he added. Both are examples of small, capable, relatively cheap spacecraft for planetary exploration. "We now have a sophisticated prototype of a long-distance rover that could start exploring the Moon in the very near future."

The test site in Kilauea Volcano's summit caldera and southwest rift zone is located about 30 miles (48 kilometers) southwest of the town of Hilo. This barren, volcanic terrain is similar to what scientists expect to find on another planet. At an elevation of 4,000 feet (120,000 centimeters), the remote site has sparse vegetation and is comprised of ash deposits, jagged rocks and loose, crumbly lava.

During the first three days of tests, Feb. 13-15, scientists will control the Marsokhod using a Virtual Environment Vehicle Interface (VEVI) software program to simulate a Mars mission. Scientists are hoping to make the tests as realistic as possible.

Upon completion of the Mars and lunar simulation tests, the team will then transport the rover to a site in the park where lava flows into the sea at Lae Apuki. From Feb. 27 to March 11, the Marsokhod will participate in the JASON VI "Island Earth" Project, a nationwide educational outreach program.

Ames, along with more than 20 other locations throughout the country, will serve as a Primary Interactive Network (PIN) site for the JASON project. During the two-week project, approximately 8,000 fourth through eighth grade students at Ames will join thousands of other students at other sites in a series of live interactive television broadcasts from Hawaii featuring scientists working on a variety of experiments, including the rover tests. Sixty students at the PIN sites will be chosen to operate the rover during the live broadcasts.

Pioneered by Dr. Robert Ballard, the scientist who discovered the wrecks of the R.M.S. Titanic and Bismark, the JASON Project offers an electronic field trip for thousands of students to interact with scientists during the expedition.

Co-sponsors of the Ames PIN site include the Bechtel Group, Inc., of San Francisco; the Oracle Corporation, Redwood Shores, CA; and the Pacific Telesis Foundation, San Francisco. Each of the three organizations contributed $25,000 to support the PIN site so that Bay Area children could experience this unprecedented educational activity.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

Video Advisory

National Aeronautics and
Space Administration
Washington, DC 20546
(202) 358-1600

For Release

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

February 12, 1995

VIDEO ADVISORY: V95-13

SHUTTLE ROLL OUT, ROBOTICS AND CARBON RESEARCH ON NTV FEB. 13

NASA Television will provide footage of the Space Shuttle Endeavour's roll out to the launch pad at the Kennedy Space Center, FL, in preparation for an upcoming March astronomy mission. Also on Monday's video feed, NTV will air the story of a unique NASA robot that combines virtual reality and robotic technology being developed at the Johnson Space Center, Houston, followed by an interview with a robotics engineer discussing the potential use of the robot for space applications. Monday's feed will conclude with a video news release from the Stennis Space Center showing how scientsits examine changes in the amount of carbon in swamp lands, part of NASA's continuing research on global environmental changes.

ITEM #1:	*Space Shuttle Endeavour roll out for March mission*	TRT: 4:04
ITEM #2:	*Virtual reality at your fingertips video*	TRT: 4:15
ITEM #3:	*Interview with Larry Li, NASA robotics engineer*	TRT: 1:42
ITEM #4:	*Stennis research on carbon levels*	TRT: 6:22

Combined TRT: approximately 20 minutes. Transmission times: 12pm, 3pm, 6pm and 9pm EST.

Public Affairs Contacts:

Endeavour roll out:	Kennedy Space Center Newsroom, 407/867-2468
Johnson robotic research:	Johnson Space Center Newsroom, 713/483-5111
Stennis carbon research:	Stennis Space Center Newsroom, 601/688-3341

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Debra Rahn
Headquarters, Washington, DC
(Phone: 202/358-1639)

February 13, 1995

Mark Hess
Headquarters, Washington, DC
(Phone: 202/358-1776)

Kyle Herring
Johnson Space Center, Houston
(Phone: 713/483-5111)

NOTE TO EDITORS: N95-8

FEB. 21 PRESS DAY FOR ASTRONAUTS TRAINING AT STAR CITY, RUSSIA

NASA astronauts Norman E. Thagard, M.D., and Bonnie J. Dunbar, Ph.D., currently training in Russia, will participate in a press day opportunity at Gagarin Cosmonaut Training Center on Tues., Feb. 21, 1995. The event will begin at 11 a.m. (Moscow time) and will include a tour of the training facilities and simulators used to prepare cosmonauts for space flight. Media also will have interview opportunities with the prime and backup Mir 18 cosmonauts/astronauts.

U.S. news media organizations wishing to obtain press accreditation to cover this event should contact Ms. Debra Rahn, Public Affairs Officer, International Relations, NASA Headquarters, by phone at 202/358-1639 or by fax at 202/358-2983.

Thagard and Dunbar were selected last year as the prime and backup crew members for a three-month flight on the Russian space station Mir in 1995 and have been training in Star City, Russia, since February 1994.

Thagard will be launched to Mir along with two Russian cosmonauts. The three-member crew will spend approximately 90 days aboard the space station. Near the end of the Mir 18 mission, Space Shuttle Atlantis on Shuttle mission STS-71 will be launched and will dock with the Mir space station.

-more-

During 4 1/2 days of docked operations, the STS-71 crew, which will include Dunbar, will work with the Mir crew on joint medical and science operations. The STS-71 Shuttle crew also will include two Russian cosmonauts to begin a new expedition aboard Mir, designated Mir 19. They will replace Thagard and the Mir 18 crew who will return to Earth at the conclusion of Atlantis' mission.

-end-

EDITORS' NOTE: NASA plans to carry the Mir 18 crew press conference live on NASA Television starting at 8:00 a.m. EST (4:00 p.m. local Moscow time). Due to the limited time set aside for the press conference, two-way Q&A capability from the United States will not be provided. Mr. Kyle Herring will be available at the Gagarin Cosmonaut Training Center on Feb. 21 to assist the visiting media.

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

For Release

February 13, 1995

VIDEO ADVISORY: V95-14

PROTEIN CRYSTAL GROWTH, MARS SURVEYOR PROJECT ON NTV FEB. 14

NASA Television will provide footage of Dr. Larry Delucas studying protein crystal growth in space during the July 1992 Space Shuttle mission STS-50. An interview with Dr. Delucas, Acting Chief Scientist for the international Space Station, will discuss plans to grow and research protein crystals aboard the Space Station. A brief animation of the fully assembled Space Station, expected to be in orbit in the year 2002, also will be shown. NTV will then air a video and interview profiling the Mars Global Surveyor Project, featuring project manager Glenn Cunningham. A taped replay of the roll out of Space Shuttle Endeavour at the Kennedy Space Center, FL, will be aired, with the day's feed concluding with a look at virtual reality and robotic engineering research being conducted at the Johnson Space Center, Houston.

ITEM #1:	*NASA scientist studies protein crystals in space*	TRT: 4:24
ITEM #2:	*Interview with Dr. Larry Delucas*	TRT: 3:22
ITEM #3:	*International Space Station -- animation*	TRT: 1:33
ITEM #4:	*Mars exploration technology*	TRT: tbd
ITEM #5:	*Interview with Mars Global Surveyor Project Manager*	TRT: :58
ITEM #6:	*Space Shuttle Endeavour roll out for March mission*	TRT: 4:04
ITEM #7:	*Virtual reality at your fingertips*	TRT: 4:15
ITEM #8:	*Interview with Larry Li, NASA robotics engineer*	TRT: 1:42

Combined TRT: approximately 30 minutes. Transmission times: 12 p.m., 3 p.m., 6 p.m. and 9 p.m. EST.

Public Affairs Contacts

Protein Crystal Growth:	Mike Braukus, 202/358-1979
Mars Global Surveyor Project:	Ed McNevin, 818/364-5011

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Laurie Boeder
Headquarters, Washington, DC
(Phone: 202/358-1898)

February 15, 1995

FUERTH AWARDED NASA EXCEPTIONAL ACHIEVEMENT MEDAL

Leon Fuerth, Assistant to the Vice President for National Security Affairs, has been awarded one of the space agency's highest honors for his work in promoting cooperation between the American and Russian space programs.

Fuerth, 55, was presented the NASA Exceptional Achievement Medal Feb. 14 by NASA Administrator Daniel S. Goldin. The medal is awarded for significant accomplishments which contribute to the mission of NASA.

The award citation read: "In recognition of your leadership, dedication, and commitment to formulating and developing relationships with the Russians resulting in the establishment of international space cooperation. Your contributions will benefit the Nation and the people of the world for generations to come."

Fuerth served as a commissioned officer in the U.S. Air Force from 1962 to 1965 and in the U.S. Foreign Service from 1968 to 1979. He worked as a professional staff member of the House Permanent Select Committee on intelligence from 1979 to 1984. From 1984 to January 1993, Fuerth served as Senior Legislative Assistant for National Security to then-Senator Albert Gore, Jr.

Fuerth is married to the former Lynne Gittelson and has four daughters. He resides in Falls Church, VA.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

For Release

February 15, 1995

VIDEO ADVISORY: V95-16

MARS ROVER, SURGICAL ROBOT ON NASA TV FEB. 16

NASA Television's next video feed will show footage and animation of the proposed Mars rover that is being tested this week in Hawaii. The rover is a demonstration of a robot applying new technologies for exploration of distant planets, a research effort lead by NASA's Ames Research Center, Moffet Field, CA. NTV will then feature footage of a NASA developed robot that can assist a surgeon in performing microsurgery on eyes, internal organs and other surgically challenging areas of the human body. An interview with Dr. Paul Schenker, Group Supervisor of Man-Machine Systems will follow. Footage of Dr. Larry Delucas studying protein crystal growth in space during the July 1992 Space Shuttle mission will be aired, followed by an interview with Delucas, Acting Chief Scientist for the international Space Station. Delucas will discuss how protein crystals grown aboard the Space Station can improve life on Earth. A brief animation of the fully assembled Space Station, expected to be in orbit in the year 2002, also will be shown. A taped replay of the roll out of Space Shuttle Endeavour at the Kennedy Space Center, FL, will be aired, with the day's feed concluding with a look at virtual reality and robotic engineering research being conducted at the Johnson Space Center, Houston.

ITEM #1: *Mars rover in Hawaii*	TRT: 5:15
ITEM #2: *Surgical Robot*	TRT: 2:18
ITEM #3: *Interview with Dr. Paul Schenker, man-machine systems*	TRT: 2:31
ITEM #4: *NASA scientist studies protein crystals in space*	TRT: 4:24
ITEM #5: *Interview with Dr. Larry Delucas*	TRT: 3:22
ITEM #6: *International Space Station -- animation*	TRT: 1:33
ITEM #7: *Space Shuttle Endeavour roll out for March mission*	TRT: 4:04
ITEM #8: *Virtual reality at your fingertips*	TRT: 4:15
ITEM #9: *Interview with Larry Li, NASA robotics engineer*	TRT: 1:42

Combined TRT: approximately 30 minutes. Transmission times: 12 p.m., 3 p.m., 6 p.m. and 9 p.m. EST.

Public Affairs Contacts

Mars rover:	Mike Mewhinney, 415/604-9000
Surgical robot:	Ed McNevin, 818/364-5011

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Dwayne C. Brown
Headquarters, Washington, DC
(Phone: 202/358-1600)

For Release
February 17, 1995

NOTE TO EDITORS: N95-9

NASA CALLS FOR SUBMISSIONS FOR 1995 SOFTWARE OF THE YEAR AWARD

NASA is calling for submissions for the 1995 NASA Software of the Year Award to give recognition to software developed and owned by the space agency.

The award is co-sponsored by the Office of Safety and Mission Assurance, Washington, DC, and NASA's Inventions and Contributions Board (ICB). Last year the competition drew responses from 135 participants, with nearly $200,000 awarded. The winning teams in 1994, INS3D from Ames Research Center and CARES/Life from Lewis Research Center, each received a prize of $40,000.

The award, which will include a trophy, certificate signed by the NASA Administrator, and a substantial award, will be presented to author(s) of software (1) in which NASA has an intellectual property interest, (2) that has been supported, adopted, sponsored, or used by NASA and (3) that which is significant to the NASA mission.

Entries will be judged by a NASA Software Award Review Panel comprised of software development experts from all NASA Centers and the Jet Propulsion Laboratory. After their review, the panel will submit their selection(s) to the ICB. The ICB may recommend a monetary award of up to $100,000 for the winner(s) depending on the value of the contribution to government and industry. The award will be presented by NASA officials later in the year.

NASA Form 1329 (ICB Award Evaluation Questionnaire) must be filled out for each entry. Copies of the software, sample applications and data, and descriptive documentation of the package should be included, in addition to evidence demonstrating the impact and degree of innovation and suitability of the entry. This information will be the primary data used by the panel in recommending awards. Software programs must have been legally disseminated as commercial-grade (not alpha or beta phase) products to the public by NASA beginning within the last five years.

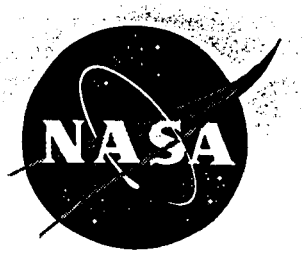
Inquiries on award criteria should be made through the NASA Space Act Awards Liaison Officer at any NASA Center or through the ICB. Call 202/358-2468 for names of these contacts. Entries and supporting material must be submitted to these offices no later than May 1, 1995.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600



For Release
February 17, 1995

Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

NOTE TO EDITORS: N95-10

NEW MANIFEST FOR NASA LAUNCHES NOW AVAILABLE

NASA's Office of Space Flight today released a new listing of planned space launches with the publication of the February 1995 Payload Flight Assignments NASA Mixed Fleet Manifest.

The new manifest listing includes payload flight assignments for the Space Shuttle through calendar year 1998 and NASA Expendable Launch Vehicles missions through calendar year 2002. The Shuttle manifest planning for 1999-2002 is omitted pending resolution of the required Space Station assembly sequence launch dates.

Changes in the manifest since the previous edition (April 1994) include a change in the Shuttle flight rate which has been adjusted from eight to seven times per year. The flight rate change was done to accommodate changes in the Shuttle operations budget. Calendar year 1998 was added to the new manifest and includes the first five Space Station flights. The new manifest also includes the seven scheduled Shuttle-Mir missions with all Shuttle-Mir flights being assigned to Space Shuttle Atlantis.

The 1995 Payload Flight Assignments NASA Mixed Fleet Manifest is available in the newsroom at Headquarters and the NASA field center newsrooms.

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

February 17, 1995

Donald Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Tammy Jones
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-5566)

Ray Villard
Space Telescope Science Institute, Baltimore, MD
(Phone: 410/338-4562)

NOTE TO EDITORS: N95-11

NEW HUBBLE IMAGES DEPICT VIOLENT STAR BIRTH AND DEATH

Two new Hubble Space Telescope (HST) images show the colorful and often violent events in the life of stars. The images will be available from NASA Headquarters on Tuesday, Feb. 21.

The first image, from Hubble's Wide Field and Planetary Camera-2, depicts the core of the nearest starburst spiral galaxy, NGC 253, revealing violent star formation within a region 1,000 light-years across. A starburst galaxy has an exceptionally high rate of star birth. Hubble's high resolution allows astronomers to distinguish, for the first time, various complex structures in the starburst activity at the core of the galaxy including dust lanes which trace regions of dense gas and filaments of glowing gas. Hubble identifies several regions of intense star formation, which include a super-bright compact star cluster.

The second image shows a small portion of a nebula called the "Cygnus Loop." Covering a region in the sky six times the diameter of the full Moon, the Cygnus Loop is actually the expanding blastwave from a stellar cataclysm - a supernova explosion - which occurred about 15,000 years ago. The supernova blast wave has recently hit a cloud of denser-than-average interstellar gas. This collision drives shock waves into the cloud that heats interstellar gas, causing it to glow.

- end -

EDITOR'S NOTE: copies of these images are available to news media representatives by calling the Broadcast and Imaging Branch on 202/358-1900.
The photo numbers for NGC 253 are: B&W: 95-H-79 color: 95-HC-76
The photo numbers for Cygnus Loop are: B&W: 95-H-80 color: 95-HC-77

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

February 19, 1995

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

VIDEO ADVISORY: V95-18

ROBOTICS, NEW HUBBLE IMAGES, PREVIEW OF NEXT MISSION ON NTV FEB. 20 & 21

On Monday, Feb. 20, NASA Television will show footage and animation of the proposed Mars rover that is being tested this week in Kilauea, HI. The rover is a demonstration of a robot applying new technologies for exploration of distant planets, a research effort lead by NASA's Ames Research Center, Moffet Field, CA. Also on Monday, NTV will feature animation and brief interviews with the crew of the next Space Shuttle mission, scheduled for launch March 2. On Tuesday, Feb. 21, NTV will begin the days feed with two new images from the Hubble Space Telescope, after which footage of crew training for the March Shuttle mission will be aired, along with an extended interview with mission commander Stephen Oswald.

On Monday, Feb. 20, NTV will air:

ITEM #1:	*Mars rover in Hawaii*	TRT: 6:47
ITEM #2:	*Robot driven by telepresence demonstration*	TRT: 1:08
ITEM #3:	*Underwater and land roving vehicles operated remotely*	TRT: 6:14
ITEM #4:	*Mars landscape -- animation*	TRT: 2:16
ITEM #5:	*Interviews with robotic engineers*	TRT: 1:36
ITEM #6:	*Upcoming astronomy mission preview -- animation*	TRT: 2:05
ITEM #7:	*Interview with mission commander Stephen Oswald*	TRT: 3:58
ITEM #8:	*Interview with lieutenant commander Wendy Lawrence*	TRT: 2:43
ITEM #9:	*Interview with mission specialist John Grunsfeld*	TRT: 2:04
ITEM #10:	*Interview with payload specialist Ronald Parise*	TRT: 3:27
ITEM #11:	*Interview with pilot William Gregory*	TRT: 3:30
ITEM #12:	*Interview with payload commander Tamara Jernigan*	TRT: 4:16
ITEM #13:	*Interview with payload specialist Samuel Durrance*	TRT: 6:30

On Tuesday, Feb. 21, NTV will air:

ITEM #1:	*New Hubble Space Telescope images*	TRT: 1:00
ITEM #2:	*Upcoming astronomy mission preview -- animation*	TRT: 2:05
ITEM #3:	*Astronaut straining for upcoming mission*	TRT: 5:45
ITEM #4:	*Expanded interview with mission commander Stephen Oswald*	TRT: 31:00

All TRT's times are approximate and subject to change.
Transmission times: 12 p.m., 3 p.m., 6 p.m. and 9 p.m. EST.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Dwayne Brown
Headquarters, Washington, DC
(Phone: 202/358-1600)

February 23, 1995

Fred Brown
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-7277)

RELEASE: 95-16

NASA AWARDS $481.6 MILLION CONTRACT TO HUGHES

NASA has awarded Hughes Aircraft Co., Los Angeles, CA, a contract to design, build and checkout on-orbit three Tracking and Data Relay Satellite (TDRS) satellites.

The competitive firm-fixed-price contract, valued at $481,641,325, will become effective immediately and run through Feb. 28, 2008. The contract will provide for three spacecraft under the TDRS replenishment program, including Ka-band communications services, as well as any necessary modifications to the two TDRS ground terminals at the White Sands Complex, NM.

The contract which also includes the management, development, integration and test, shipment, launch support, and operations support of the spacecraft, marks the first time NASA has used a new and innovative procurement method to maximize the quality and reliability of NASA hardware.

In the past, NASA developed detailed specifications which contractors were required to meet. For this procurement, NASA adopted commercial practices, identifying requirements and allowing offeror's flexibility in determining how to meet those requirements.

"During the competition, offerors also had to propose a payback schedule. Historically, in many case contractors were not held accountable for failures. This time, in the event of a spacecraft failure, NASA will be reimbursed. This commercial practice will save NASA money and ensure that taxpayers get their money's worth," said Charles Force, Associate Administrator for Space Communications.

-more-

The contract will directly support NASA's TDRS System by continuing the present function of the existing TDRS spacecraft through replenishment of the existing fleet beginning in 1999. The TDRS provides the only existing means of continuously communicating with orbiting spacecraft at high data rates, a capability required by nearly all low Earth-orbiting spacecraft including the Space Shuttle.

NASA's Office of Space Communications, Washington, DC, is responsible for overall program management of the TDRS System. NASA's Goddard Space Flight Center, Greenbelt, MD, manages the operation of the TDRS System.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

February 23, 1995

Donald Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Tammy Jones
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-5566)

Ray Villard
Space Telescope Science Institute, Baltimore, MD
(Phone: 410/338-4562)

RELEASE: 95-17

HUBBLE FINDS OXYGEN ATMOSPHERE ON JUPITER'S MOON EUROPA

Astronomers using NASA's Hubble Space Telescope (HST) have identified the presence of an extremely tenuous atmosphere of molecular oxygen around Jupiter's second moon, Europa. The planets Mars and Venus are the only two other solar system objects beyond Earth known to have traces of molecular oxygen in their atmospheres.

This detection was made by a team of researchers at the Johns Hopkins University and the Space Telescope Science Institute, both in Baltimore, and is reported in the Feb. 23 issue of the journal "Nature."

"Europa's oxygen atmosphere is so tenuous that its surface pressure is barely one hundred billionth that of the Earth," said Principal Investigator Doyle Hall, of Johns Hopkins. "If all the oxygen on Europa were compressed to the surface pressure of Earth's atmosphere, it would fill only about a dozen Houston Astrodomes. It is truly amazing that the Hubble Space Telescope can detect such a tenuous trace of gas so far away."

Scientists had predicted previously that Europa might have an atmosphere containing gaseous oxygen, but had to wait for Hubble's sensitive instruments for confirmation. The HST researchers caution that the detection should not be misinterpreted as evidence for the presence of life on the small, frigid moon. Located 490 million miles (780 million kilometers) from the Sun, Europa's surface is too cold, measured at -230 degrees Fahrenheit (-145 degrees Celsius), to support life as we know it.

- more -

Unlike Earth, where organisms generate and maintain a 21% oxygen atmosphere, Europa's oxygen atmosphere is produced by purely non-biological processes. Europa's icy surface is exposed to sunlight and is impacted by dust and charged particles trapped within Jupiter's intense magnetic field. Combined, these processes cause the frozen water ice on the surface to produce water vapor as well as gaseous fragments of water molecules.

After the gas molecules are produced, they undergo a series of chemical reactions that ultimately form molecular hydrogen and oxygen. The relatively lightweight hydrogen gas escapes into space, while the heavier oxygen molecules accumulate to form an atmosphere which may extend 125 miles (200 kilometers) above the surface. The oxygen gas slowly leaks into space and must be replenished continuously.

Europa is approximately the size of Earth's Moon, but its appearance and composition are markedly different. The satellite has an unusually smooth and nearly craterless surface of solid water ice. Mysterious dark markings crisscross the surface, giving the moon a "cracked eggshell" appearance. Under the apparently fragmented icy crust, tidal heating by Jupiter might heat the icy material enough to maintain a subsurface ocean of liquid water.

Of the 61 identified moons in the solar system, only three other satellites are known to have atmospheres: Jupiter's volcanically active moon Io (sulfur dioxide), Saturn's largest moon Titan (nitrogen/methane) and Neptune's largest moon Triton (nitrogen/methane).

The definitive detection of Europa's tenuous atmospheric oxygen was made possible by the ultraviolet sensitivity provided by HST's Goddard High Resolution Spectrograph (GHRS) instrument. The GHRS recorded the spectral signature of molecular oxygen (O2) on Europa in ultraviolet light during observations made on June 2, 1994, over a period of six Hubble orbits. Europa was then at a distance of 425 million miles (684 million kilometers) from Earth.

The Hubble observations will be invaluable for scientists who are planning close-up observations of Europa as part of NASA's Galileo mission, which will arrive at Jupiter in December 1995. During its initial entry into the Jovian system on Dec. 7, Galileo will fly by Europa at a distance of less than 22,000 miles (35,000 kilometers).

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency.

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

95-18

SPACE SHUTTLE MISSION STS-67

PRESS KIT
MARCH 1995

PUBLIC AFFAIRS CONTACTS

For Information on the Space Shuttle

Ed Campion Headquarters, Wash., DC	Policy/Management	202/358-1778
Rob Navias Johnson Space Center, Houston, TX	Mission Operations Astronauts	713/483-5111
Bruce Buckingham Kennedy Space Center, FL	Launch Processing KSC Landing Information	407/867-2468
June Malone Marshall Space Flight Center Huntsville, AL	External Tank/SRBs/SSMEs	205/544-0034
Cam Martin Dryden Flight Research Center Edwards, CA	DFRC Landing Information	805/258-3448

For Information on STS-67 Experiments & Activities

Don Savage Headquarters, Wash., DC	ASTRO-2	202/358-1547
Mike Braukus Headquarters, Wash., DC	PCG	202/358-1979
Tammy Jones Goddard Space Flight Center Greenbelt, MD	GAS	301/286-5566
Jim Cast Headquarters, Wash., DC	MACE, CMIX	202/358-1779
Terri Hudkins Headquarters, Wash., DC	SAREX	202/358-1977

CONTENTS

RELEASE: 95-18

ASTRO TELESCOPES MAKE SECOND FLIGHT ON STS-67 MISSION

This March, Space Shuttle Endeavor will conduct NASA's longest Shuttle flight to date carrying unique ultraviolet telescopes that will give astronomers a view of the universe impossible to obtain from the ground.

The mission, designated STS-67, also will see Endeavour's crew perform a wide range of microgravity processing experiments, continue efforts in understanding the structure of proteins and study active control of flexible structures in space.

Launch of Endeavour is scheduled for March 2, 1995 at approximately 1:37 a.m. EST from NASA's Kennedy Space Center's Launch Complex 39-A. Endeavour's flight will be 15 days, 13 hours, 32 minutes. A 1:37 a.m. launch on March 2, would result in a landing at Kennedy Space Center's Shuttle Landing Facility on March 17, at 3:09 p.m. EST.

The STS-67 crew will be commanded by Stephen S. Oswald who will be making his third Shuttle flight. William G. Gregory, who will be making his first space flight, will serve as pilot. The three mission specialists aboard Endeavour will include John M. Grunsfeld, Mission Specialist-1 (MS-1) who will be making his first flight, Wendy B. Lawrence, Mission Specialist-2 (MS-2) who will be making her first flight and Tamara E. Jernigan, Payload Commander and Mission Specialist 3 (MS-3) who will be making her third flight. Rounding out the crew will be two payload specialists who flew on ASTRO-1 during the STS-35 mission in December 1990. Samuel Durrance will serve as Payload Specialist-1 (PS-1) and Ronald Parise will serve as Payload Specialist-2. Both Parise and Durrance will be making their second space flight.

The Astro Observatory, making its second flight aboard a Space Shuttle, is a package of three instruments mounted on the Spacelab Instrument Pointing System (IPS). The Hopkins Ultraviolet Telescope will conduct spectroscopy in the far ultraviolet portion of the electromagnetic spectrum, allowing scientists to learn what elements are present in targeted celestial objects, as well as identify physical processes taking place.

The second instrument, the Ultraviolet Imaging Telescope, will take wide-field photographs of objects in ultraviolet light, recording the images on film for processing back on Earth. The third instrument, the Wisconsin Ultraviolet Photo-Polarimeter Experiment, will measure the intensity of ultraviolet light and its degree of polarization. The instrument will give astronomers clues to the geometry of a star or the composition and structure of the interstellar medium it illuminates.

Simultaneous observations by these three telescopes will complement one another as they provide different perspectives on the same celestial objects. These observations also will complement those of ultraviolet instruments on other NASA spacecraft, such as the Hubble Space Telescope, the International Ultraviolet Explorer, and the Extreme Ultraviolet Explorer -- all currently in operation. By combining research findings from these various instruments, scientists hope to piece together the evolution and history of the universe and learn more about the composition and origin of stars and galaxies.

The flight also will see the continuation of NASA's Get Away Special (GAS) experiments program. The project gives individuals an opportunity to perform experiments in space on a Shuttle mission. Two GAS cans will be carried in the cargo bay in support of a payload from the Australian Space Office. The payload, coincidentally named Endeavour, is an Australian space telescope that will take images in the ultraviolet spectrum of violent events in nearby exploding galaxies.

The third in a series of six Commercial MDA ITA Experiments (CMIX) payloads will also fly aboard Endeavour. CMIX-03 includes biomedical, pharmaceutical, biotechnology, cell biology, crystal growth and fluids science investigations. These experiments will explore ways in which microgravity can benefit drug development and delivery for treatment of cancer, infectious diseases and metabolic deficiencies. These experiments also will include protein and inorganic crystal growth, experiments on secretion of medically important products from plant cells, calcium metabolism, invertebrate development and immune cell functions.

Endeavour will carry two systems in Shuttle middeck lockers to continue space-based research into the structure of proteins and other macromolecules. The study of proteins, complex biochemicals that serve a variety of purposes in living organisms, is an important aspect of this mission. Determining the molecular structure of proteins will lead to a greater understanding of how the organisms function. Knowledge of the structures also can help the pharmaceutical industry develop disease-fighting drugs. The two systems are the Vapor Diffusion Apparatus in which trays will be housed within a temperature-controlled Thermal Enclosure System and the Protein Crystallization Apparatus for Microgravity that will be housed in a Single-locker Thermal Enclosure System.

The Middeck Active Control Experiment is an experiment designed to study the active control of flexible structures in space. In this experiment, a small, multibody platform will be assembled and free-floated inside the Space Shuttle. Tests will be conducted on the platform to measure how disturbances caused by a payload impact the performance of another nearby payload which is attached to the same supporting structure.

The STS-67 crew will take on the role of teachers as they educate students in the United States and other countries about their mission objectives. Using the Shuttle Amateur Radio Experiment-II, Shuttle Commander Stephen S. Oswald (call sign KB5YSR), pilot William G. Gregory, (license pending), mission specialists Tamara E. Jernigan (license pending) and Wendy B. Lawrence (KC5KII) and Payload Specialists Ron Parise (WA4SIR) and Sam Durrance (N3TQA) will talk with students in 26 schools in the U.S., South Africa, India and Australia using "ham radio", about what it is like to live and work in space.

The STS-67 mission will be the 8th flight of Space Shuttle Endeavour and the 68th flight of the Space Shuttle system.

- end -

MEDIA SERVICES INFORMATION

NASA Television Transmission

NASA Television is available through Spacenet-2 satellite system, transponder 5, channel 9, at 69 degrees West longitude, frequency 3880.0 MHz, audio 6.8 Megahertz.

The schedule for television transmissions from the Orbiter and for mission briefings will be available during the mission at Kennedy Space Center, FL; Marshall Space Flight Center, Huntsville, AL; Dryden Flight Research Center, Edwards, CA; Johnson Space Center, Houston; NASA Headquarters, Washington, DC; and the NASA newscenter operation at Mission Control-Moscow. The television schedule will be updated to reflect changes dictated by mission operations.

Television schedules also may be obtained by calling COMSTOR 713/483-5817. COMSTOR is a computer data base service requiring the use of a telephone modem. A voice update of the television schedule is updated daily at noon Eastern time.

Status Reports

Status reports on countdown and mission progress, on-orbit activities and landing operations will be produced by the appropriate NASA newscenter.

Briefings

A mission press briefing schedule will be issued prior to launch. During the mission, status briefings by a Flight Director or Mission Operations representative and when appropriate, representatives from the payload team, will occur at least once per day. The updated NASA television schedule will indicate when mission briefings are planned.

Access by Internet

NASA press releases can be obtained automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service.

Informational materials also will be available from a data repository known as an anonymous FTP (File Transfer Protocol) server at ftp.pao.hq.nasa.gov under the directory /pub/pao. Users should log on with the user name "anonymous" (no quotes), then enter their E-mail address as the password. Within the /pub/pao directory there will be a "readme.txt" file explaining the directory structure.

The NASA public affairs homepage also is available via the Internet. The page contains images, sound and text (press releases, press kits, fact sheets) to explain NASA activities. It also has links to many other NASA pages. The URL is: **http://www.nasa.gov/hqpao/hqpao_home.html**

Access by fax

An additional service known as fax-on-demand will enable users to access NASA informational materials from their fax machines. Users calling (202) 358-3976 may follow a series of prompts and will automatically be faxed the most recent Headquarters news releases they request.

Access by Compuserve

Users with Compuserve accounts can access NASA press releases by typing "GO NASA" (no quotes) and making a selection from the categories offered.

STS-67 QUICK LOOK

Launch Date/Site:	March 2, 1995/KSC Pad 39A
Launch Time:	1:37 a.m. EST
Launch Window:	2 hours, 30 minutes
Orbiter:	Endeavour (OV-105) - 8th flight
Orbit/Inclination:	190 nautical miles/28.45 degrees
Mission Duration:	15 days, 13 hours, 32 minutes
Landing Time/Date	March 17, 1995
Landing Time:	3:09 p.m. EST
Primary Landing Site:	Kennedy Space Center, FL
Abort Landing Sites:	Return to Launch Site - KSC Transoceanic Abort Landing - Ben Guerir, Morocco Moron, Spain Abort Once Around - Edwards Air Force Base, CA
Crew:	Steve Oswald, Commander (CDR), Red Team Bill Gregory, Pilot (PLT), Red Team John Grunsfeld, Mission Specialist 1 (MS 1), Red Team Wendy Lawrence, Mission Specialist 2 (MS 2), Blue
Team:	Tammy Jernigan, Payload Commander, Mission Specialist -3 (MS 3), Blue Team Sam Durrance, Payload Specialist 1 (PS 1), Blue Team Ron Parise, Payload Specialist 2 (PS 2), Red Team
Extravehicular Crewmembers:	Jernigan (EV 1), Grunsfeld (EV 2)
Cargo Bay Payloads:	ASTRO-2 Getaway Special Canisters
Middeck Payloads:	MACE PCG-STES CMIX PCG-TES
In-Cabin Payloads:	SAREX-II

Developmental Test Objectives/Detailed Supplementary Objectives:

DTO 251:	Entry Aerodynamic Control Surfaces Test
DTO 254:	Subsonic Aerodynamics Verification
DTO 301D:	Ascent Structural Capability Evaluation
DTO 307D:	Entry Structural Capability
DTO 312:	External Tank Thermal Protection System Performance
DTO 319D:	Orbiter/Payload Acceleration and Acoustics Data
DTO 414:	APU Shutdown Test
DTO 667:	Portable In-Flight Landing Operations Trainer (PILOT)
DTO 674:	Thermoelectric Liquid Cooling System Evaluation
DTO 700-8:	Global Positioning System Developmental Flight Test
DTO 700-9:	Orbiter Evaluation of TDRS Acquisition in Bypass Mode
DTO 805:	Crosswind Landing Performance
DSO 326:	Window Impact Observations
DSO 328:	In-Flight Urine Collection Absorber Evaluation
DSO 484:	Assessment of Circadian Shifting in Astronauts by Bright Light
DSO 487:	Immunological Assessment of Crewmembers
DSO 488:	Measurement of Formaldehyde Using Passive Dosimetry
DSO 603:	Orthostatic Function During Entry, Landing and Egress
DSO 604:	Visual-Vestibular Integration as a Function of Adaptation
DSO 605:	Postural Equilibrium Control During Landing/Egress
DSO 608:	Effects of Space Flight on Aerobic and Anaerobic Metabolism
DSO 614:	The Effect of Prolonged Space Flight on Head and Gaze Stability during Locomotion
DSO 624:	Pre and Postflight Measurement of Cardiorespiratory Responses to Submaximal Exercise
DSO 626:	Cardiovascular and Cerebrovascular Responses to Standing Before and After Space Flight
DSO 901:	Documentary Television
DSO 902:	Documentary Motion Picture Photography
DSO 903:	Documentary Still Photography

SPACE SHUTTLE ABORT MODES

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, Orbiter and its payload. Abort modes for STS-67 include:

* Abort-To-Orbit (ATO) -- Partial loss of main engine thrust late enough to permit reaching a minimal 105-nautical mile orbit with the orbital maneuvering system engines.

* Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit of the Earth before landing at Edwards Air Force Base, CA.

* TransAtlantic Abort Landing (TAL) -- The loss of one or more main engines midway through powered flight would force a landing at either Moron, Spain, or Ben Guerir, Morocco.

* Return-To-Launch-Site (RTLS) -- Early shutdown of one or more engines, before the Shuttle has enough energy to reach Moron or Ben Guerir, would result in a pitch around and thrust back toward KSC until the Orbiter is within gliding distance of the Shuttle Landing Facility.

MISSION SUMMARY TIMELINE

Flight Day One:
Launch/Ascent
OMS-2 Burn
Astro/Spacelab Activation
Instrument Pointing System Activation
Astro Observations

Flight Day Two:
Astro Observations

Flight Day Three:
Astro Observations
MACE Operations

Flight Day Four:
Astro Observations
MACE Operations

Flight Day Five:
Astro Observations

Flight Day Six:
Astro Observations
Off-Duty Time for MS 3 and PS 1

Flight Day Seven:
Astro Observations
MACE Operations
Off-Duty Time for MS 1 and PS 2

Flight Day Eight:
Astro Observations

Flight Day Nine:
Astro Observations
MACE Operations

Flight Day Ten:
Astro Observations
MACE Operations

Flight Day Eleven:
Astro Observations
Off-Duty Time for MS 3 and PS 1

Flight Day Twelve:
Astro Observations
MACE Operations
Off-Duty Time for MS 1 and PS 2

Flight Day Thirteen:
Astro Observations
Crew News Conference

Flight Day Fourteen:
Astro Observations
Flight Control System Checkout
Instrument Pointing System Stow Check and Redeployment

Flight Day Fifteen:
Astro/Spacelab Deactivation
Instrument Pointing System Stow
Cabin Stow

Flight Day Sixteen:
Deorbit Prep
Deorbit Burn
Entry
KSC Landing

PAYLOAD AND VEHICLE WEIGHTS

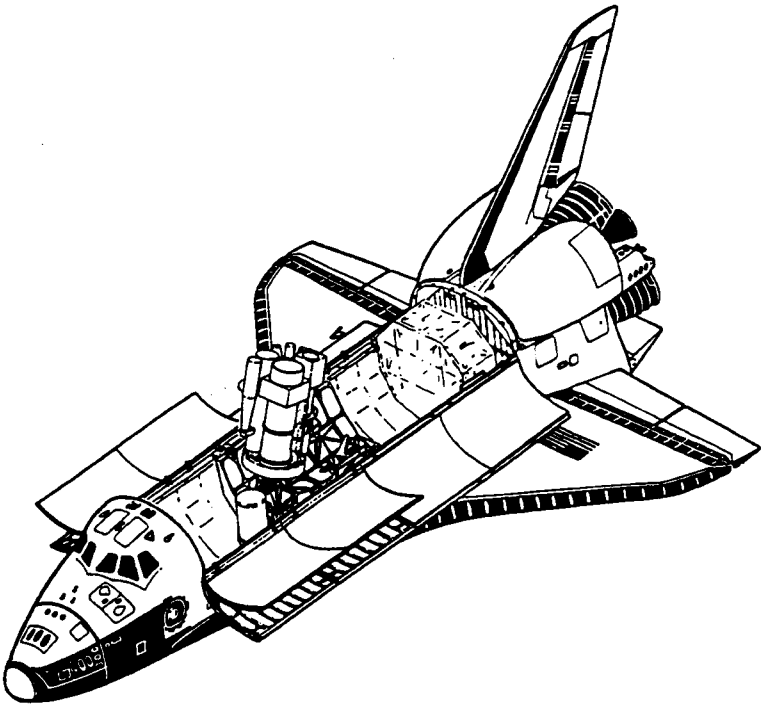
Vehicle/ Payload	Pounds
Orbiter (Endeavour) empty and 3 SSMEs	173,910
ASTRO-2 (Instruments and Support Equipment)	17,384
Getaway Special Canisters	1,000
CMIX	69
MACE (Middeck Active Control Experiment)	258
Protein Crystal Growth Experiment	205
Shuttle Amateur Radio Experiment	28
Detailed Test/Supplementary Objectives	171
Shuttle System at SRB Ignition	4,520,531
Orbiter Weight at Landing	217,683

STS-67 ORBITAL EVENTS SUMMARY

(Based on a March 2, 1995 Launch)

EVENT	MET	TIME OF DAY (EST)
Launch	0/00:00	1:37 a.m., Mar. 2
OMS-2	0/00:51	2:28 a.m., Mar. 2
IPS Activation	0/03:15	4:52 a.m., Mar. 2
Crew News Conference	12/11:10	12:47 p.m., Mar. 14
FCS Checkout	13/11:45	1:22 p.m., Mar. 15
Deorbit Burn	15/12:25	2:02 p.m., Mar. 17
KSC Landing	15/13:32	3:09 p.m., Mar. 17

ASTRO-2 OBSERVATORY IN STS-67 PAYLOAD BAY



CREW RESPONSIBILITIES

Payloads and Activities	Prime	Backup
ASTRO	Jernigan	Grunsfeld, Durrance, Parise
Getaway Specials	Grunsfeld	Lawrence
MACE	Oswald	Gregory
PCG	Lawrence	Gregory
CMIX	Gregory	Lawrence
SAREX	Parise	Oswald

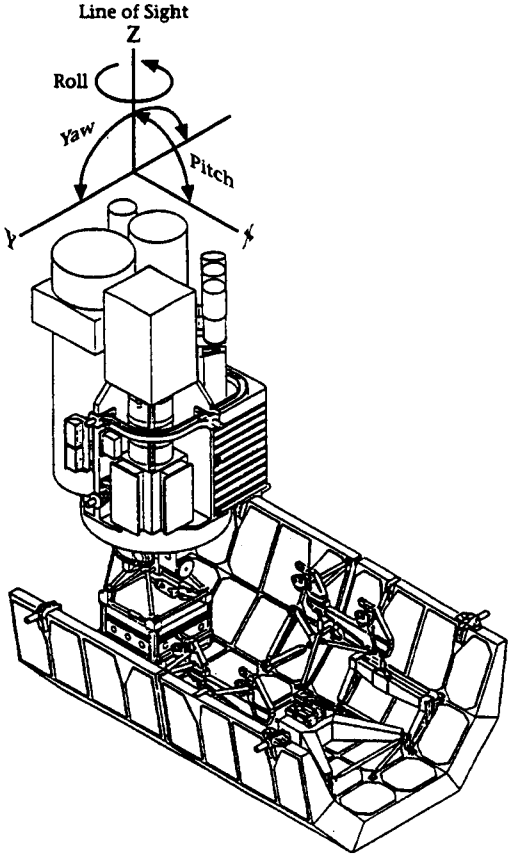
DTOs/ DSOs

DTO 251:	Entry Aerodynamics Test	Oswald	Gregory
DTO 312:	Tank TPS Performance	Grunsfeld	Lawrence
DTO 667:	PILOT	Oswald	Gregory
DSO 484:	Circadian Shifting	Jernigan, Lawrence, Durrance	
DSO 487:	Immunological Assessment	All	
DSO 603C:	Entry Monitoring	Jernigan, Grunsfeld, Durrance, Parise	
DSO 604:	Head/Eye Movement	Grunsfeld, Parise, Oswald	
DSO 608:	Aerobic/Anaerobic	Oswald, Gregory, Lawrence	
DSO 605:	Postural Equilibrium	Oswald, Gregory	
DSO 614:	Head and Gaze Stability	Gregory, Grunsfeld	
DSO 624:	Submaximal Exercise	Durrance, Parise	
DSO 626:	Extended Stand Test	Jernigan, Grunsfeld, Durrance, Parise	

Other Activities:

Photography/TV	Grunsfeld	Lawrence, Gregory
In-Flight Maintenance	Gregory	Lawrence, Oswald
Earth Observations	Grunsfeld	Lawrence
Medical	Oswald	Jernigan

ASTRO-2 OBSERVATORY INSTRUMENT CONFIGURATION



ASTRO-2

A cluster of unique telescopes will turn the Space Shuttle Endeavour into an Earth-orbiting ultraviolet observatory. This set of mechanized "eyes" will give astronomers a view of the heavens impossible to obtain from the ground.

The mission, which will study some of the most energetic events in the cosmos, builds on the experience and scientific data obtained on the first Astro flight in 1990. This second mission will fill gaps in knowledge about ultraviolet astronomy, expand and refine existing data, and help astronomers better understand our dynamic universe.

NASA's Marshall Space Flight Center in Huntsville, AL, supervised development of the Astro observatory and manages Astro missions for the Astrophysics Division of NASA's Office of Space Science, Washington, DC.

Why Ultraviolet Astronomy?

Since the earliest days of astronomy, people have used the light from stars to test their understanding of the universe. However, the visible light that can be studied from Earth is only a small portion of the radiation produced by celestial objects. Other forms of radiation -- like lower energy infrared light and higher energy ultraviolet light and X-rays -- are absorbed by the atmosphere and never reach the ground.

Seeing celestial objects in visible light alone is like looking at a painting in only one color. To fully appreciate the meaning of the painting, viewers must see it in all of its colors.

Getting above the atmosphere with space instruments like the Astro ultraviolet telescopes lets astronomers add some of these "colors" to their view of stars and galaxies.

The universe of ultraviolet astronomy is strikingly different from our familiar night sky. Most stars fade from view, too cool to emit much ultraviolet radiation. But very young massive stars, some very old stars, glowing nebulae, active galaxies, quasars and white dwarfs stand out when observed with instruments sensitive to ultraviolet radiation.

Before the advent of orbiting ultraviolet telescopes, scientists had to be satisfied with rocket-borne ultraviolet telescopes. In fact, all three Astro telescopes are based on prototypes flown separately on sounding rockets. A typical rocket flight might gather 300 seconds of data on a single object. During Astro-2, scientists expect their three telescopes to gather hundreds of hours of data on a multitude of celestial objects.

THE ASTRO TELESCOPES

The Astro Observatory is a package of three instruments, mounted on the Spacelab Instrument Pointing System.

The **Hopkins Ultraviolet Telescope** (HUT), developed at The Johns Hopkins University, Baltimore, MD, conducts spectroscopy in the far ultraviolet portion of the electromagnetic spectrum. Spectroscopy allows scientists to learn what elements are present in an object, as well as identify physical processes taking place there.

The **Ultraviolet Imaging Telescope** (UIT), developed by NASA's Goddard Space Flight Center, Greenbelt, MD, takes wide-field photographs of objects in ultraviolet light, recording the images on film for processing back on Earth.

The **Wisconsin Ultraviolet Photo-Polarimeter Experiment** (WUPPE), developed at the University of Wisconsin at Madison, measures the intensity of ultraviolet light and its degree of polarization. When light waves are polarized, or vibrate in a preferred direction rather than randomly, they give astronomers clues to the geometry of a star or the composition and structure of the interstellar medium it illuminates.

Simultaneous observations by the three telescopes complement one another, as they provide different perspectives on the same celestial objects.

Astro-2 observations also complement those of ultraviolet instruments on other NASA spacecraft, such as the Hubble Space Telescope, the International Ultraviolet Explorer, and the Extreme Ultraviolet Explorer -- all currently in operation. By combining research findings from various instruments, scientists hope to piece together the evolution and history of the universe and learn more about the composition and origin of stars and galaxies.

Astro-1

The first flight of the Astro observatory took place in December 1990 and lasted nine days. In addition to the ultraviolet telescopes, the observatory included an X-ray instrument called the Broad-Band X-ray Telescope mounted on a separate pointing system.

During this mission the Astro team learned a number of valuable lessons about operating a Shuttle-based astronomical observatory in orbit -- lessons that will be put to good use during the Astro-2 mission.

The Astro-1 instruments captured the first views of many celestial objects in extremely short ultraviolet wavelengths, took the first detailed ultraviolet photographs of many astronomical objects, and made the first extensive studies of ultraviolet polarization.

The end of 1994 saw more than 110 scientific articles published on Astro-1 results by these four instrument teams.

One of the first-covered Hopkins Ultraviolet Telescope observations was designed to test a theory which had been proposed about the nature of so-called "dark matter," -- a substantial portion of the universe's mass that astronomers have been unable to account for. The observation effectively disproved the theory, leaving the "missing mass" in the universe as mysterious as ever.

Successive papers reveal an impressively wide range of scientific insights obtained by Astro-1. Observations covered everything from solar system objects, nearby interstellar medium, distant quasars, star clusters, galaxies, individual nebulae and stars. Each observation helps to fill in gaps in our understanding of the physics of these objects.

ASTRO-1 RESULTS AND ASTRO-2 GOALS

Many Astro-2 observations will build on discoveries from Astro-1, while others will seek to answer additional questions about the ultraviolet universe.

• **Stellar evolution.** Stars like Earth's Sun are the most common type, emitting most of their radiation in visible light. But young stars being formed, and some old stars in later stages of their evolution, shine brighter in ultraviolet wavelengths.

On Astro-1, UIT images identified rings of massive star formation in several galaxies, and roughly half of the instrument's science program on Astro-2 is devoted to studies of star-forming galaxies. A unique UIT contribution is the identification of thousands of individual hot stars in other galaxies for later study by NASA's Hubble Space Telescope.

UIT also photographed globular clusters, where there are often so many stars grouped together that it is impossible to distinguish individual stars. The ultraviolet images picked out hot stars in late stages of evolution, where hydrogen has been depleted from the cores and energy is provided by burning helium. By comparing photographs taken in different wavelengths, scientists were able to measure the temperature as well as brightness of the individual stars.

Observing more globular clusters is a high priority for the imaging telescope on Astro-2. Astronomers will compare the observations to theoretical predications, to help fill in gaps in their knowledge about these late evolutionary stages.

All three Astro-2 telescopes will study white dwarf stars. These are old stars in a transition phase -- former giants which have shed their cool outer layers, leaving dormant cores containing a Sun's worth of mass within a sphere the size of Earth. The hottest white dwarf stars, perhaps as hot as 200,000 degrees Fahrenheit (110,000 degrees Celsius), are very unstable and pulsate every five to ten minutes.

• **Spinning stars.** One of the surprises from Astro-1 were observations of stars that are spinning very fast, called Be stars. A Be star is thought to be surrounded by a disk of gas lost from the star. WUPPE found that the amount of polarized light coming from these stars was less than is seen in visible light and

less than expected in the ultraviolet, indicating that some of the ultraviolet polarized light was being removed by the gas in the disk around the star. The wavelengths in the ultraviolet where polarized light was missing told astronomers that there are apparently atoms of gaseous iron in the disks close to Be stars. The WUPPE team will try to learn more about the gaseous disks by viewing more Be stars during Astro-2.

• **Cataclysmic variables.** Astro-1 ultraviolet telescopes observed cataclysmic variables -- dual star systems which occasionally increase dramatically in brightness as a dense old star called a white dwarf pulls material from its companion normal star. One particularly interesting observation was of a variable near the peak of its brightness, which Astro-1 was able to view after a support network of amateur astronomers using ground-based telescopes reported seeing an outburst in progress. Results from the Astro-1 observations did not match theoretical predictions, causing a re-evaluation of current theories about this type of star system.

Scientists will use follow-up observations during Astro-2 to learn more about what triggers the sudden outbursts of energy in cataclysmic variables, which can increase their brightness 100 times or more.

• **Supernova remnants.** Supernova remnants are the ghosts of dead stars, expanding gaseous nebulae created by stellar explosions. Observing the young remnants of a supernova's explosion provides the only direct test of a process called nucleosynthesis, whereby lighter elements are manufactured into heavier elements in the centers of stars. Observations of old supernova remnants actually probe conditions in interstellar space as the shock wave encounters clouds of interstellar material.

During Astro-1, all three ultraviolet telescopes observed the Cygnus Loop, the remnant of an explosion some 40,000 years ago. Observations detected a much higher temperature and therefore much greater velocity of its shock wave than had been predicted. The telescopes also studied the Crab Nebula, a relatively young supernova remnant.

Astro-2 observations will include the Cygnus Loop and several other supernovas as well.

• **Galaxy morphology.** Galaxies come in a variety of shapes and sizes, such as gigantic spirals like the Earth's Milky Way, egg-shaped ellipticals and irregular shapes with no preferred form. Studying the shapes of galaxies in the ultraviolet is a key to the study of galaxy evolution in the early universe.

Before Astro-1, there were only a handful of ultraviolet pictures of nearby galaxies available. UIT images from that mission revealed that the shapes of galaxies seen in ultraviolet wavelengths are strikingly different for their familiar forms in visible light. One UIT goal for Astro-2 is the construction of an ultraviolet atlas of spiral galaxies.

• **Active galaxies.** Observations of active galaxies by the Astro telescopes may help astronomers explain why the cores of galaxies give off large amounts of high-energy ultraviolet, X-ray and gamma-ray radiation.

Most astronomers believe that the radiation is produced by a massive black hole in the center of the galaxy, surrounded by a torus, or doughnut-shaped cloud of material. The WUPPE instrument on Astro-1 confirmed the existence of a thick torus, while another instrument showed unexpectedly high temperatures near it. These results support the idea that ultraviolet radiation is being absorbed by a disk of matter spiraling into a massive black hole.

Astro-2 observations will help confirm or refute this picture of what is happening in the centers of active galaxies.

• **Elliptical galaxies.** Astro-1 observations by both HUT and UIT shed light on a 20-year-old mystery about the source of faint, ultraviolet emissions in elliptical galaxies. Such galaxies are thought to consist almost entirely of old red stars, which do not emit large amounts of ultraviolet light. However, early astronomical satellites showed that these elliptical galaxies increase in brightness at short ultraviolet wavelengths.

The Astro-1 studies ruled out some proposed explanations for the ultraviolet emissions, and they found strong evidence for a previously unknown stage of stellar evolution that apparently is occurring in these galaxies. During Astro-2, both UIT and HUT will observe more elliptical galaxies to confirm and extend these ideas.

• **Interstellar dust.** On Astro-1, WUPPE used half a dozen bright stars like flashlights to illuminate the interstellar medium, literally shedding new light on the chemical composition and physical nature of the "dust" between stars in our Milky Way galaxy. Surfaces of these dust grains are thought to provide a safe haven for the formation of molecules, clouds of which are the "womb" for the formation of each generation of new stars.

Astro-1 observations revealed that some parts of the galaxy seem to have dust grains that may look like tiny hockey pucks, while other parts seem to have a mixture of several sizes, shapes and kinds of dust grains. Previously, astronomers had thought properties of this interstellar dust were the same wherever the dust was found. A major Astro-2 goal for WUPPE will be to determine whether these different types of dust grains form because conditions in some parts of the galaxy are different than they are in other areas.

• **Primordial intergalactic gas.** The primary Astro-2 goal for the Hopkins telescope is to detect the existence of primordial intergalactic gas, an investigation it did not get to perform on Astro-1.

This helium gas in the vast space between galaxies is thought to be left over from the "Big Bang," the primordial fireball which marked the beginning of the universe. Existence of the gas is a logical consequence of the "Big Bang" theory.

HUT will look for evidence of intergalactic helium by observing the light of an extremely distant object called a quasar, located behind the gas, much as a hazy mist can be viewed when it is illuminated by the beam of a distant flashlight. Helium in the intervening gas would absorb light of a specific frequency from the quasar, altering the chemical signature the quasar could normally be expected to produce.

A recent Hubble Space Telescope observation found evidence of intergalactic helium in the spectrum of one quasar. However, HUT's spectral region permits looking at more nearby quasars. Positive results from Astro-2 observations would not only verify the Hubble findings, but they could allow the density and ionization state of the gas to be measured as well.

• **Solar system objects.** HUT made several observations of the planet Jupiter and its moon Io during Astro-1, studying the dynamic nature of their relationship. Io, the most volcanically active body in the solar system, spews out volcanic material into space, where it is ionized and swept up by Jupiter's strong magnetic field. Ultraviolet observations permit a better understanding of the temperatures and densities of the resulting plasma. Scientists were able to use HUT's more detailed spectra to reinterpret data gathered by the Voyager spacecraft in the late 1970s.

More studies of Jupiter will be performed during Astro-2. The observations will help determine the importance to Jupiter's atmosphere of extreme ultraviolet radiation from the Sun. The telescopes also will look for changes in the planet's upper atmosphere resulting from recent impacts by fragments of Comet Shoemaker-Levy 9.

ASTRO-2 INSTRUMENTS

Hopkins Ultraviolet Telescope (HUT)

Principal Investigator: Dr. Arthur F. Davidsen
The Johns Hopkins University
Baltimore, MD

The Hopkins Ultraviolet Telescope conducts spectroscopy in the far ultraviolet portion of the electromagnetic spectrum. During Astro-2, it will study a wide variety of objects, ranging from our own solar system and galactic neighborhood to very distant objects near the edge of the observable universe.

The instrument team's highest priority for Astro-2 is the search for intergalactic helium thought to be left over from a primordial fireball that marked the birth of the universe about 10 to 20 billion years ago. HUT astronomers will attempt to analyze light shining through this gas by observing distant quasars.

The portion of the spectrum observed by the Hopkins telescope, coupled with the instrument's sensitivity, enables it to see a slice of the ultraviolet universe which other observatories are unable to detect. HUT's spectral region covers wavelengths shorter than those observed by the Hubble Space Telescope and the International Ultraviolet Explorer and longer than the Extreme Ultraviolet Explorer satellite.

HUT uses a 36-inch (0.9 meter) mirror, located in the back of the telescope tube, to focus ultraviolet light from astronomical objects into a spectrograph set in the middle of the telescope. The spectrograph "spreads" ultraviolet light into a spectrum which can be studied in detail, in much the

same way as a prism separates visible light into a rainbow of colors. It then measures the brightness of the light at each wavelength.

By analyzing how the brightness varies across the wavelengths, scientists can determine the elements present in the object, the relative amounts of each element, and the temperature and density of the object. From this, astronomers can gain a better understanding of the physical processes occurring in or near the object being studied.

HUT was designed and built by Johns Hopkins University astrophysicists and engineers at the university's Applied Physics Laboratory in Laurel, MD. More than two dozen faculty, staff and students from Johns Hopkins currently are involved in the project.

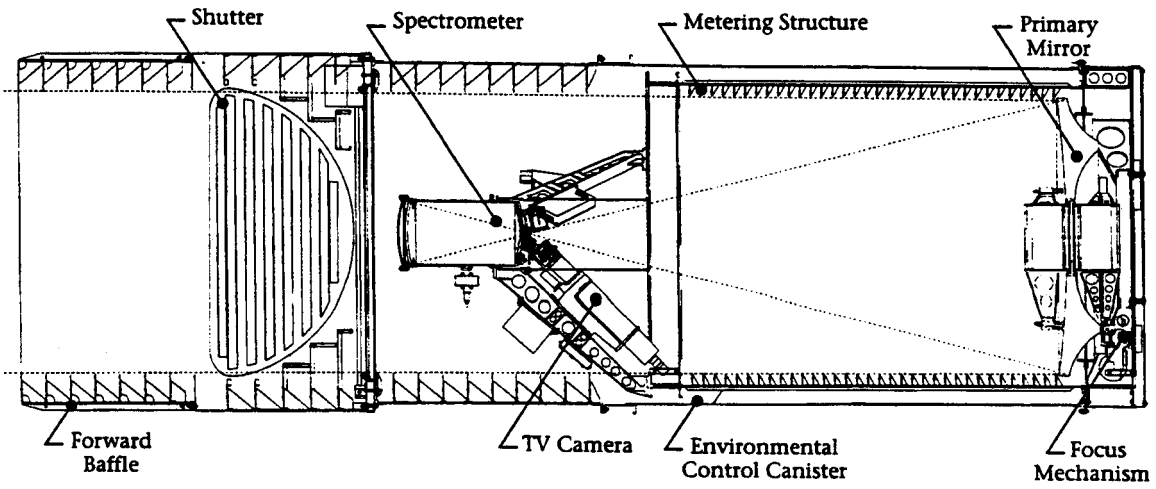
During Astro-1, HUT made numerous observations of active galactic nuclei, quasars, cataclysmic variables, nebulae, supernova remnants, solar system objects and other astronomical objects, many of which had never been studied before in the energy range unique to HUT.

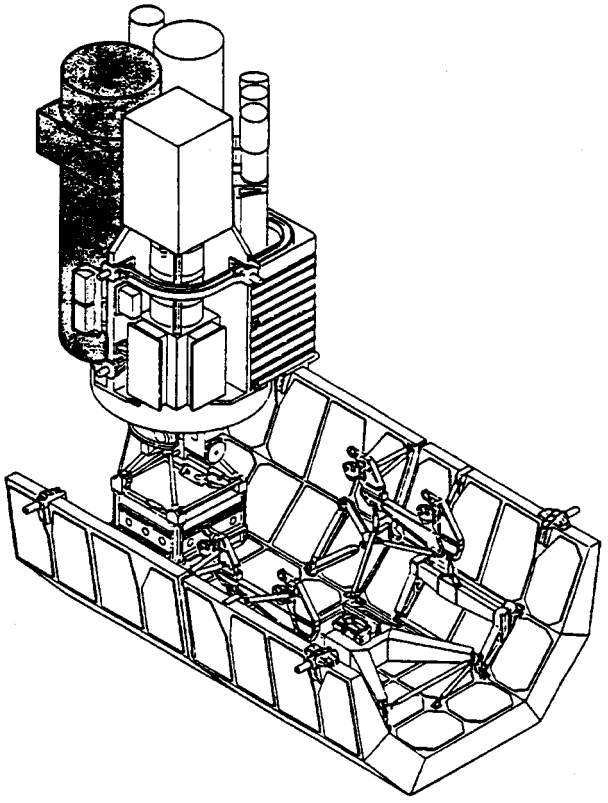
The telescope has been improved significantly for Astro-2, and the science team expects it to be about three times more sensitive to the far ultraviolet spectrum than it was on its first mission. This will allow them to obtain higher quality spectra and to observe fainter objects. The primary mirror has been coated with silicon carbide, which is much more reflective to far ultraviolet light than the iridium coating on the original HUT mirror. The spectrograph grating also has been coated with silicon carbide.

Each time the Astro-2 telescopes point for a new observation, astronauts and ground controllers will use visible-light images on HUT's closed circuit TV camera to identify the desired targets and to verify that the telescope is pointing accurately.

Spectra from the observations will be downlinked to the HUT science team in Huntsville, where Johns Hopkins scientists will record the data. About 60 days after landing all of the science and engineering data will be sent to Baltimore. Scientists there will continue the detailed process of analyzing their collected information.

THE HOPKINS ULTRAVIOLET TELESCOPE





Hopkins Ultraviolet Telescope (HUT)

Telescope Optics:	Silicon carbide-coated parabolic mirror
Aperture:	36 inches (90 centimenters)
Focal Ratio:	f/2
Guide TV Field of View:	10 arc-minutes
Spectral Resolution:	3.0 Angstroms
Wavelength Range:	830 to 1860 Angstroms (limited sensitivity in 500 to 750 Angstrom range)
Magnitude Limit:	16
Detector:	Prime Focus Rowland Circle Spectrograph with microchannel plate intensifier and electronic diode array detector
Weight:	1,736 pounds (789 kilograms)
Dimensions:	44 inches (1.1 meter) diameter 12.1 feet (3.7 meters) length

---

Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE)

Principal Investigator: Dr. Arthur D. Code
University of Wisconsin
Madison, WI

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) measures the polarization and intensity of ultraviolet radiation from celestial objects.

Photometry is the measurement of the intensity (brightness) of the light, while polarization is the measurement of the orientation (direction) of the vibrating light wave.

Light is made up of electric and magnetic waves that vibrate from side to side, up and down, and diagonally. The polarization of light is a measure of how much more the waves vibrate in one direction than the others.

Usually, light waves vibrate randomly, thus are said to be unpolarized. The waves become polarized when they encounter a particular object or force which causes them to vibrate in a preferred direction. For example, polarization occurs when light is emitted in the presence of a magnetic field or when it passes through clouds of dust grains aligned by an interstellar magnetic field. The light from a comet's tail is reflected sunlight that becomes polarized when it is scattered by the ice and dust particles left in the comet's wake. This is similar to the way that polarized sunglasses reduce the glare of scattered light.

Determining the amount and direction of polarization and how these change with wavelength can tell scientists what caused the light waves to vibrate in a preferred direction — indicators of a celestial object's geometry and other physical conditions, or about the reflecting properties of tiny particles in the interstellar medium along the radiation's path.

The primary processes responsible for polarization within individual celestial objects are enhanced in observations of hotter, more energetic ultraviolet radiation. The background clutter common in visible light studies is greatly reduced, which is important since polarization of the interstellar medium usually is not as strong in ultraviolet as in visible wavelengths.

Natural light also can become polarized when it passes through a cloud containing dust grains aligned by an interstellar magnetic field. From this scientists learn about the kinds of grains and can map out the magnetic fields in space.

The Wisconsin Ultraviolet Photo-Polarimeter Experiment was built by scientists, engineers and students at the University of Wisconsin-Madison's Space Astronomy Lab in the 1980s.

Before the Astro-1 flight, only one single measurement of ultraviolet polarization had ever been made. WUPPE observations from Astro-1 gave astronomers the first measurements of the ultraviolet polarization of many types of astronomical objects. The instrument provided detailed spectral data on the polarization of some three dozen stars, interstellar clouds and galaxies, and ultraviolet spectra of an additional 20 stellar objects.

A major Astro-2 goal for WUPPE is to follow up on Astro-1 observations of the interstellar medium. The science team hope to learn more about the causes of polarization and the nature of "dust" grains in the space between stars. They also will follow up on observations of active galaxies and rapidly spinning stars.

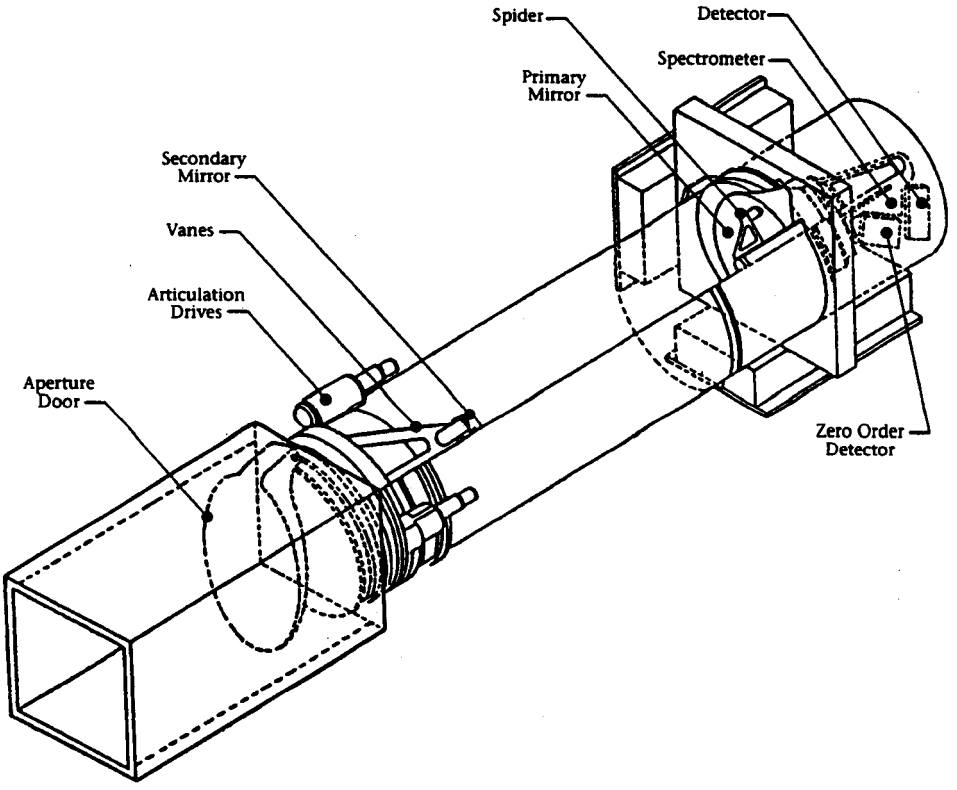
The WUPPE telescope examines ultraviolet radiation from 1,400 Angstroms (around the mid-point of the far ultraviolet range) to 3,200 Angstroms (slightly shorter wavelengths than blue visible light). This is an area that has not been readily studied, especially for stars that are too bright for Hubble's Faint Object Spectrograph and for nebulae too large for Hubble's smaller spectrograph openings.

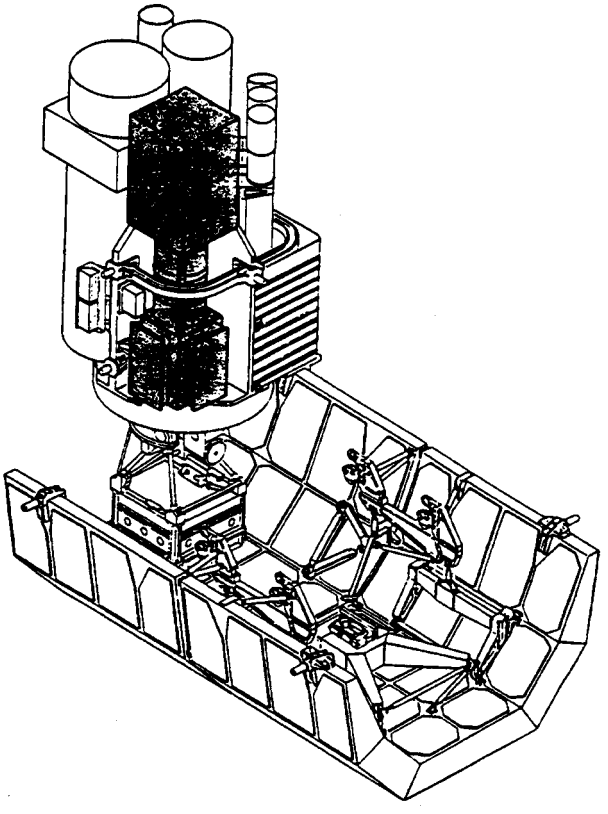
The telescope is a classical Cassegrain-type, meaning that light enters the tube and strikes a large, parabolic mirror near the back. The light then is reflected forward to a smaller, secondary mirror near the front of the telescope, which focuses the light back through a hole in the center of the large mirror. The secondary mirror can be adjusted in precise increments to refocus the telescope, to allow it to look at objects slightly offset from those other Astro instruments are studying, and to perform rapid small corrections to the telescope's pointing direction.

Behind the primary mirror, the beam passes through an ultraviolet spectrograph, a device which spreads out the radiation by wavelengths. A beam-splitting prism divides the resulting spectrum into two perpendicular planes of polarization, and the two spectra are recorded simultaneously on two

separate detectors. Comparison of the two spectra is then used to study the polarization of the ultraviolet light as a function of wavelength.

THE WISCONSIN ULTRAVIOLET PHOTO-POLARIMETER EXPERIMENT





Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE)

Telescope Optics:	Cassegrain system
Aperture:	20 inches (50 centimeters)
Focal Ratio:	f/10
Spectral Resolution:	6 Angstroms
Wavelength Range:	1,400 to 3,200 Angstroms
Magnitude Limit:	16
Detectors:	Spectropolarimeter with dual electronic diode array detectors
Weight:	981 pounds (446 kilograms)
Dimensions:	28 inches (70 centimeters) diameter 12.14 feet (3.7 meters) length

Ultraviolet Imaging Telescope (UIT)

Principal Investigator: Theodore P. Stecher
NASA Goddard Space Flight Center
Greenbelt, MD

The Ultraviolet Imaging Telescope makes deep, wide-field photographs of objects in ultraviolet light. This type of imagery is a primary means for recognizing fundamentally new phenomena or important examples of known astrophysical objects in ultraviolet wavelengths. Before Astro-1, very few ultraviolet images had been made and those that were available were taken during brief rocket flights.

The Ultraviolet Imaging Telescope observes a field of view two-thirds of a degree across, an area larger than the full Moon. This is considered "wide field" for astronomers; each UIT photo covers an area more than 250 times the size of the Hubble Space Telescope's Wide Field/Planetary Camera, though at lower angular resolution and sensitivity. For many galaxies or star clusters, this is large enough to encompass the entire object in a single photo frame. In addition, the UIT suffers much less interference from visible light, since it is provided with "solar blind" detectors.

Images made in the ultraviolet spectrum clearly show the dynamic events taking place beyond our world. The clutter of objects which produce most of their radiation in visible light disappears. Hot stars leap into prominence, the spiral arms of distant galaxies snap into clearer resolution, and the material hidden between the stars comes into view.

UIT's wide-field images are ideal for investigating astronomical questions such as the shapes of nearby galaxies as revealed in ultraviolet light, the properties of massive hot stars, the evolution of low-mass stars, and the nature of interstellar dust and gas. UIT galaxy-wide images are sky surveys that can locate bright ultraviolet stars for further more detailed study by the Hubble Space Telescope.

The Ultraviolet Imaging Telescope was developed at NASA's Goddard Space Flight Center, Greenbelt, MD. During Astro-1, UIT obtained a large number of images, including clusters of young, hot massive stars; globular clusters containing old stars, some of which are unusually hot; spiral galaxies rich with star-forming activity; and smaller "irregular" galaxies that can experience sudden bursts of star formation. Astro-2 will continue the important work of imaging the ultraviolet sky.

UIT is a powerful combination of telescope, image intensifier and camera. Unlike data from the other Astro instruments, which will be electronically transmitted to the ground, UIT images will be recorded directly on very sensitive astronomical film. The film will be processed and analyzed after Endeavour returns to Earth.

Light is reflected from a 15-inch (38-centimeter) primary mirror, at the middle of the telescope tube, to a secondary mirror near the front. The secondary mirror is linked to an image motion compensation system, which adjusts it slightly as necessary to offset any motion or jitter in the spacecraft. This is critical since any motions would blur the resulting photographs.

Reflected from the secondary mirror, the light passes through filter wheels containing six filters each. These different filters allow specific wavelengths of the ultraviolet spectrum to be selected. By comparing two images of the same area with different filters, the UIT team can measure the temperature as well as the brightness of every object in the field.

The light then enters one of the telescope's two image intensifier/film transport units. The image intensifiers amplify and convert the ultraviolet light into a visible image that can be recorded on astronomical film. Each unit contains 1,000 film frames.

A 30-minute exposure can record a blue star of 25th magnitude, about 100 million times fainter than the faintest visible light star which could be seen by the naked eye on a clear, dark night. Developed after the mission, each frame of film is digitized to form an array of 2,048 x 2,048 picture elements, called pixels, for computer analysis. This analysis produces quantitative information about the objects whose images appear on the film.

Ultraviolet Imaging Telescope (UIT)

Telescope Optics:	Ritchey-Chretien
Aperture:	15 inches (38 centimeters)
Focal Ratio:	f/9
Field of view:	40 arc-minutes
Angular Resolution:	2 arc-seconds
Wavelength Range:	1,200 to 3,200 Angstroms
Magnitude Limit:	25
Detectors:	Two image intensifiers with 70-millimeter film, 1,000 frames each, IIaO astronomical film
Weight:	1,043 pounds (474 kilograms)
Dimensions:	32 inches (81 centimeters) diameter 12.1 feet (3.7 meters) length

The Astro-2 Mission

Like Astro-1, the Astro-2 observatory will be housed inside the Shuttle's payload bay, with astronomers serving as payload specialists operating the telescopes from the aft flight deck of the Shuttle. As the Shuttle Endeavour orbits 220 miles above Earth, a large contingent of scientists and engineers will guide the mission from NASA's Spacelab Mission Operations Control Center at Marshall Space Flight Center in Huntsville.

The ultraviolet telescope assembly rests on two Spacelab pallets in Endeavour's cargo bay. The Shuttle and Spacelab systems provide power, pointing and communications links for the observatory.

The telescopes are mounted on the Instrument Pointing System (IPS), which was part of the Spacelab equipment developed for NASA by the European Space Agency. It has been used twice before, on Spacelab 2 in 1985 and on Astro-1 in late 1990.

The IPS furnishes a stable platform, keeps the telescopes aligned, and provides various pointing and tracking capabilities to the telescopes. During Astro-1 the IPS had some difficulties locking onto guide stars properly, although an alternate technique allowed the astronauts to manually point the IPS and track targets. In general, the astronauts were able to provide pointing stability of about 2 to 3 arc seconds or better. However, in "optical hold", the IPS should be able to achieve sub-arc-second stability. A special task team put together by mission management at Marshall has extensively modified and tested the IPS software and made other improvements to ensure the IPS works properly for Astro-2.

Marshall's image motion compensation system, designed to eliminate jitter caused by crew motions and thruster firings during observations, will refine pointing and stability even further for the photo-polarimeter and the imaging telescope. When the system senses unwanted motion in the instruments, it sends signals which adjust the telescopes' mirrors to reduce

jitter. This is particularly important for UIT to maintain the quality of its imagery, since the pictures are recorded on film and a single exposure can last as long as 30 minutes.

After launch, the plan calls for a roughly 20-hour checkout period, though fine-tuning the observatory could take somewhat longer. Observations will begin immediately after checkout is complete and continue throughout the mission, with only brief interruptions for activities such as waste-water dumps and Shuttle tests.

The night launch will allow the Shuttle Endeavour to pass through the so-called South Atlantic Anomaly, where high-energy radiation dips closer to the Earth than usual, mainly on the daylit side of its orbit. High energy particles affect instrument operation and increase the background levels in electronic detectors. The "natural" background, such as scattered light and ultraviolet residual airglow emissions, is also higher on the daylit side. The nighttime launch therefore preserves orbital night passes — when Earth is between the Shuttle and the Sun — for observations of the faintest, and often highest priority, astronomical targets. Brighter targets will be observed during the day.

The mission timeline, a detailed "blueprint" of the flight's science activities, is divided into two-orbit (three-hour) blocks. One of the three telescope teams will have priority for the entire time block and will select the observations during that period. Generally, the other two telescopes will observe the same object or something nearby, though some targets may be too bright for the imaging telescope to view.

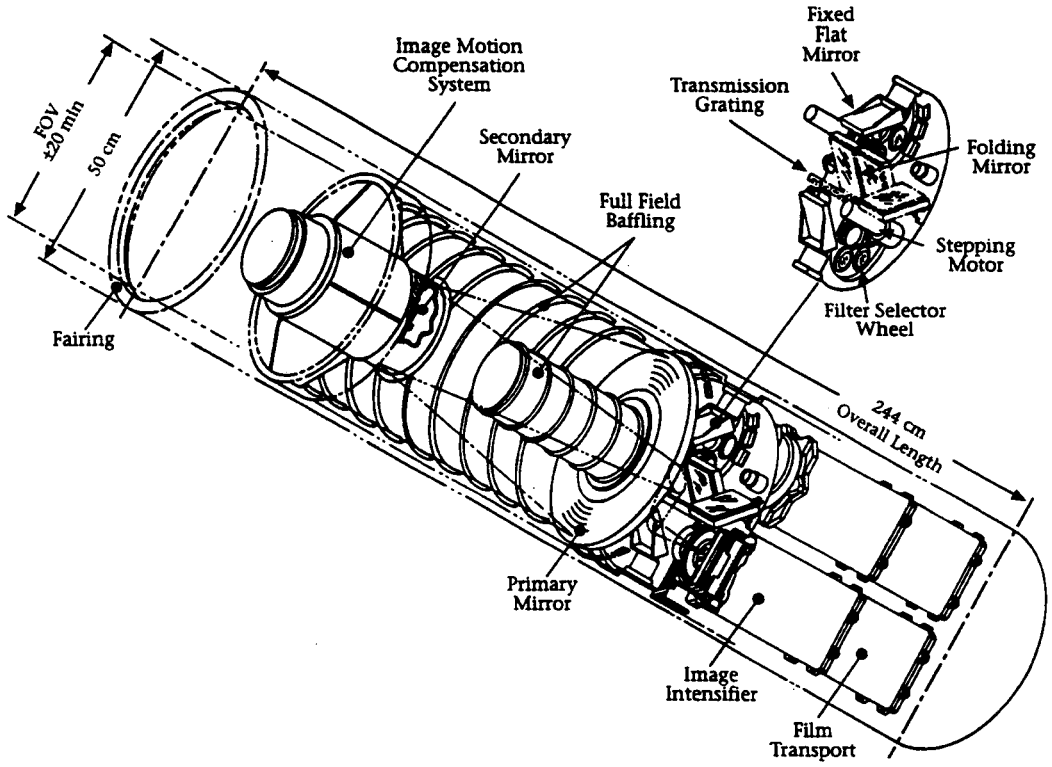
The seven-member Astro-2 crew will be split into two 12-hour shifts, so astronomical observations can continue around the clock.

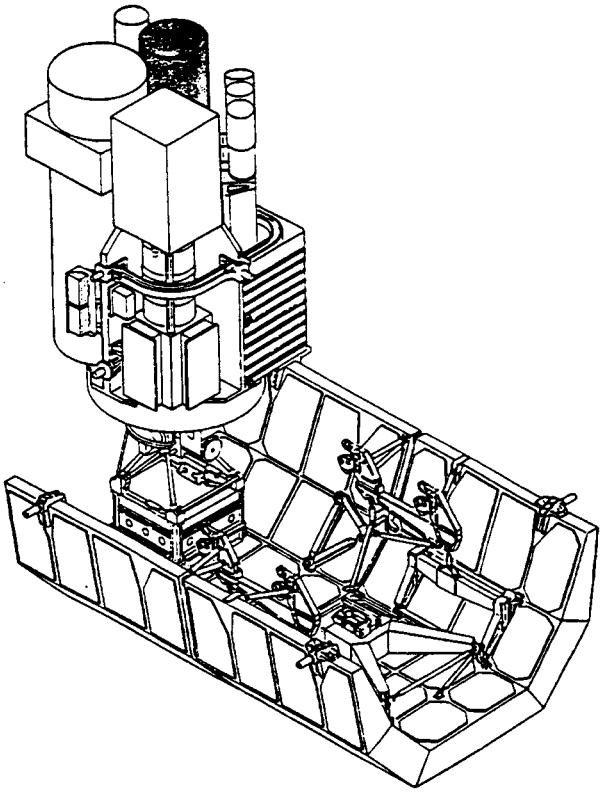
To begin an observation, an Orbiter crew member will maneuver the Shuttle's payload bay to point toward the celestial object being studied.

The two science crew members on each shift, a NASA mission specialist and a payload specialist (an astronomer chosen from among the experiment teams), will have the option of using a pre-programmed, automatic sequence to maneuver the Instrument Pointing System and lock onto guide stars, or they may choose to acquire the target manually using a joystick-type device. Generally, the mission specialist will be responsible for pointing the telescope assembly, and the payload specialist will control the actual instrument set-ups and observations.

Astronomers on each instrument team will receive telescope data at Spacelab control and adjust their observations as needed to obtain the best possible results. If the data reveal something unexpected, or if an unforeseen astronomical event occurs (like the cataclysmic variable outburst during Astro-1), the instrument teams will work with Marshall payload controllers to develop changes in the timeline. This allows the investigators to explore the unexpected and take advantage of science opportunities that may arise during the mission.

THE ULTRAVIOLET IMAGING TELESCOPE





Guest Investigators

One new feature for Astro-2 is "community involvement." Although each of the instruments was developed by a team of scientists and engineers at a particular university or government facility, "guest investigators" also will use the Astro telescopes for their own observations. In 1993 NASA solicited proposals from the general astronomical community for participation in the observatory's second flight. After scientific and technical peer review, NASA selected ten proposals for inclusion into the scientific program. This has produced an even broader range of observations that will be attempted and scientific investigations that will be carried out.

Astro-2 principal guest investigators and their experiments are:

The Near UV Properties of Galaxies Which Have Low Optical Surface Brightness (UIT)
Dr. Gregory D. Bothun
University of Oregon
Eugene, OR

Ultraviolet Extinction and Polarization of Interstellar Dust in the Large Magellanic Cloud (HUT, WUPPE)
Dr. Geoffrey C. Clayton
University of Colorado
Boulder, CO

O-VI Emission and Broad-Band UV Spectra of Symbiotic Systems (HUT, WUPPE)
Dr. Brian R. Espey
The Johns Hopkins University
Baltimore, MD

Investigations of Lyman Line Profiles in Hot DA White Dwarfs (HUT)
Dr. David S. Finley
EUREKA Scientific, Inc.
Oakland, CA

An Ultraviolet Survey/Atlas of Spiral Galaxies (UIT)
Dr. Wendy L. Freedman
Carnegie Institution of Washington
Pasadena, CA

Astro-2 Observations of the Moon (UIT)
Dr. George R. Gladstone
Southwest Research Institute
San Antonio, TX

HUT Observations of the Lyman Continuum in Starburst Galaxies (HUT)

Dr. Claus H. Leitherer
Space Telescope Science Institute
Baltimore, MD

Far UV Observations of Interstellar Shocks (HUT)
Dr. John C. Raymond
Smithsonian Institution Astrophysical Observatory
Cambridge, MA

The Extended Atmospheres of Wolf-Rayet Stars (HUT, WUPPE)
Dr. Regina E. Schulte-Ladbeck
University of Pittsburgh
Pittsburgh, PA

A Reconnaissance of O3 Spectra in the 900-1200 Angstrom Region (HUT)
Dr. Nolan R. Walborn
Space Telescope Science Institute
Baltimore, MD

ASTRO-2 MANAGEMENT TEAM

Headquarters, Washington, DC

Program Manager	James McGuire
Program Scientist	Dr. Robert Stachnik

Marshall Space Flight Center

Mission Manager	Dr. Robert Jayroé
Mission Scientist	Dr. Charles Meegan
Deputy Mission Scientist	Dr. Eugene Urban
Assistant Mission Scientist	Dr. John Horack
Chief Engineer	David Jacobson
Assistant Mission Manager	Stuart Clifton
Lead Payload Operations Director	Lewis Wooten

GET AWAY SPECIAL (GAS)

The Get Away Special (GAS) project is managed by NASA's Goddard Space Flight Center, Greenbelt, MD. NASA began flying these small self-contained payloads in 1982. The project gives an individual an opportunity to perform experiments in space on a Shuttle mission. Students, individuals and people from private industry have taken advantage of this unique project. Space is available for upcoming flights, and GAS presents an educational opportunity for students. There is one experiment in two payloads on this flight. Following is a brief description of the payloads.

G-387 & G-388
Customer: Australian Space Office, Depart. of Industry Science & Technology
Customer Manager: Dr. John S. Boyd, Deputy Executive Director,
Australian Space Office, NASA Technical Manager: Charlie Knapp

Endeavour, an Australian space telescope, is very significant to the Australian space program as it makes its second flight aboard Space Shuttle Endeavour on mission STS-67. The telescope previously flew in January 1992.

Coincidentally, the Australian payload has the same name as the Shuttle Endeavour. Both were named after the sailing ship which the Captain James Cook commanded during an expedition to explore the Pacific Ocean. In doing so he discovered the eastern coast of Australia and pioneered the way for the first settlement in Australia by Europeans.

Endeavour is the most significant space payload built by the Australian space industry in more than two decades. This is the program on which many Australian engineers learned their space skills. This is particularly true for Auspace, the prime contractor for this project. More than 200 Australian companies also contributed to this pioneering space project. The Australian Space Office of the Department of Industry Science and Technology, which administers the Australian space program, provided the funds for the Endeavour program.

Outside the influence of the Earth's atmosphere, Endeavour will take images in the ultraviolet spectrum of targets which include star-forming regions, nearby galaxies and violent galactic events. Such images cannot be taken from ground-based telescopes because the radiation at these wavelengths is absorbed by the Earth's atmosphere. The Australian Space Telescope is housed in two GAS canisters that are mounted on the side of the Shuttle cargo bay and are interconnected by means of a cable harness. One of the canisters is fitted with a Motorized Door Assembly which protects the payload during launch and opens to allow observations to be made. This canister houses the telescope, the detector and the control computer.

Endeavour is a 100 mm binocular reflecting telescope. One side of the telescope allows all the light from celestial targets to enter the other side allows only light in a narrow spectral band. Thus, by the subtraction of the two signals, the narrow band image can be studied in detail as the brighter background is removed.

The detector is a very sensitive photon counting array which comprises an image tube, a fiber optic image dissector and charged coupled arrays. The detector counts individual photons, the smallest indivisible packet of light to obtain maximum efficiency at the low light level produced by these distant galaxies.

The second canister contains the battery to supply electrical power to the payload and video cassette recorders to record the images for processing on the ground after landing. The telescope has a field-of-view of two degrees and relies on the Shuttle for pointing. Shuttle motion during exposures can be removed by subsequent ground image processing.

The managing director of Auspace, Mr. T. Stapinski, said "Endeavour is a very important space project for Auspace. It is a very complex payload of over 180 kg. (396 lbs.) and we learned a lot during its manufacture and testing.

"The expertise learned on Endeavour has enabled Auspace engineers to make major contributions on other electro-optical space instrumentation such as the Along Track Scanning Radiometer for the European Remote Sensing satellite. The Flight of Endeavour is very important as it will demonstrate the capability of the Australian space industry to produce top quality space hardware."

COMMERCIAL MDA ITA EXPERIMENTS (CMIX-03)

Overview

The third in a series of six commercial experiments, known as CMIX, will fly aboard Endeavour during STS-67. CMIX-03 includes biomedical, pharmaceutical, biotechnology, cell biology, crystal growth and fluids science investigations.

These experiments will explore ways in which microgravity can benefit drug development and delivery for treatment of cancer, infectious diseases and metabolic deficiencies. These experiments also will include protein and inorganic crystal growth, secretion of medically important products from plant cells, calcium metabolism, invertebrate development and immune cell functions.

CMIX represents an innovative dual agreement program between NASA Headquarters and the University of Alabama in Huntsville (UAH) Consortium for Materials Development in Space (CMDS). UAH is one of NASA's eleven Centers for the Commercial Development of Space (CCDS). The goals of the program are to provide increased access to space for NASA's CCDS investigators and their industry affiliates and to facilitate private sector utilization of space. Through a subsequent agreement between UAH and Instrumentation Technology Associates (ITA), of Exton, PA, ITA provides flight hardware to UAH for its associated investigators and industry affiliates in exchange for flight opportunities. ITA markets both the flight opportunity and hardware as a turnkey commercial service to both domestic and international users.

On STS-67, UAH and ITA will fly more than 30 individual experiment investigations totaling some 400 samples on CMIX-03.

The most significant UAH CMDS/NASA CCDS experiments on this mission deal with microgravity research into aging, multi-drug resistance and neuro-muscular development.

The most significant ITA commercial experiments on this flight involve the growth of urokinase protein crystals as the first step for use in developing an inhibitor drug to combat breast cancer metasis, and the microencapsulation of drugs as a drug delivery system for cancer therapy.

UAH CMDS Experiments

Experiments being conducted by the UAH CMDS and collaborating scientists on the STS-67 CMIX-03 payload include aging, multi-drug effects on cells, neuro-muscular development, gravity sensing and calcium metabolism, production of plant cell products, and protein crystal growth. Some of the data expected from the CMIX-03 microgravity experiments can be used by industry to understand processes which can enhance the quality of life on Earth, and contribute to the health and welfare of the increasing numbers of persons spending time in space.

Aging

Evidence from previous microgravity experiments indicates that gravity affects single cells. No matter what effect any environmental factor produces on living systems, it begins with single cells or a group of single cells acting together. Microgravity appears to slow cell growth. How this affects the aging process will be tested using human lymphocytes.

Multi-drug Resistance

The broad objective of drug resistance experiments is to gain an understanding of the role of gravity and effect of microgravity on cell membranes. Drugs must cross cell membranes to be effective; however, many drugs lose their effectiveness after several years of use because patients develop multi-drug resistance. Researchers believe that the mechanisms of multi-drug resistance may be more easily understood for cells in microgravity where cellular metabolism is slowed.

Neuro-muscular Development

There are a number of diseases which result from faulty nerve-muscle interactions and these disorders are a target for pharmaceutical and biotechnology industry research. The development of nerve tissue is influenced by the communication between nerve and muscle cells and depends on membrane interactions. Previous flight experiments have shown that microgravity slows the growth and development of these cells and significantly alters the cytoskeleton. Frog cells will be flown as a model to investigate development of membrane associated interactions.

Gravity Sensing and Calcium Metabolism

Calcium is known to regulate many cellular activities leading to growth, differentiation, and transduction of signals from the cell membrane to produce genetic responses. The UAH investigation will fly an experiment using the Bioprocessing Modules to evaluate the development of gravity in understanding calcium dynamics in cells and has economical value in the area of calcium and bone metabolism.

Production of Plant Cell Products

Pharmaceutical products from plants have been used for treatment of various types of cancer. These plant products include vinblastin and taxol. Cultured cells from soy bean plants will be flown in the MDA minilabs to assess the effect of microgravity on growth, development and production of secondary metabolites. These cells, grown in ground-based tests, produce a product with strong anti-colon cancer activity. Preliminary evidence suggests that microgravity may provide an advantage for higher production of this material.

Protein Crystal Growth

Protein crystal growth experiments will be flown to gain information on the specific structure and growth characteristics of selected economically important proteins. Information will be used to develop more complex experiments on future missions.

Commercial ITA Experiments

The private sector commercial experiments on CMIX-03 utilizing the ITA hardware have three main thrusts: biomedical research involving the growth of protein crystals for cancer research; the microencapsulation of drugs; and an ITA-sponsored student space education program.

Urokinase Breast Cancer Experiment

The most significant commercial experiment on the CMIX-03 payload is an experiment to grow large protein crystals of urokinase for breast cancer research. Urokinase is an enzyme which is present when breast cancer spreads (cancer metastasis). ITA, with its team of scientists and engineers, will dedicate 60 to 90 space experiments to the growth of large protein crystals of at least 100 microns for analysis. Small urokinase protein crystals have been grown on the CMIX-01 (STS-52) and CMIX-02 (STS-56) Shuttle flights. The crystals were not large enough for analysis. Urokinase protein crystals grown on the ground are not large enough for analysis. If a 100+ micron protein crystal can be obtained on the CMIX-03 mission, the three-dimensional structure will be determined in the laboratories of crystallographers. A cancer research center has agreed to try to develop and test drugs to inhibit urokinase and hence breast cancer metastasis.

The scientists and engineers on the research team believe that the chance of achieving their goal of large urokinase crystals is enhanced because the STS-67 mission is twice as long (16 days) as the previous CMIX missions and the growth rate is believed to be linear. In addition, the hardware has been modified to provide two temperatures and four separate crystal growth techniques.

Microencapsulation of Drugs

The second major commercial thrust is experiments involving the encapsulation of drugs or living cells for new medical therapies. This series of commercial microencapsulation experiments will continue the studies conducted on STS-52 (CMIX-01) and STS-56 (CMIX-02) wherein an antitumor drug (cis-platinum) was co-encapsulated with a radiocontrast medium into spherical, multilayer liquid microcapsules. This is a commercial joint venture with the Institute for Research, Houston, TX.

The objectives of the Microgravity Encapsulation of Drugs (MED) are for experiments on microcapsules to enable testing against tumors in mice as a necessary step towards clinical studies in cancer patients.

Another separate group of microencapsulation experiments involves the mixing of polymer solutions which ultimately may be used to encapsulate pancreatic islet cells to facilitate transplantation into diabetic patients.

Student Space Education Program

The third major thrust involves school students as part of ITA's Student Space Education Program to increase awareness and interest in science and space technology. ITA is donating a portion of its hardware and personnel on every CMIX mission to flying student experiments as a "hands-on" experience for students. To date, some 400 students and 30 teachers from seven states have participated in this private sector-sponsored program for students to conduct Space Shuttle microgravity experiments on the CMIX payload.

CMIX-03 Payload Hardware

The CMIX-3 hardware consists of four Materials Dispersion Apparatus (MDA) Minilabs, two of which will contain experiments developed by the UAH CMDS and its industry affiliates. Additional hardware to fly on this mission includes ITA's Liquids Mixing Apparatus and UAH's BioProcessing Modules. The other two MDA'S, commercially marketed by ITA, will contain experiments developed by ITA's customers, international users, and university research institutions.

Dr. Marian Lewis, of the UAH/CMDS, is the Project Manager for the CMIX Program and Mr. John M. Cassanto, President of ITA, is the Program Manager for the commercial half of the CMIX payload.

Protein Crystal Growth Experiments

The STS-67 mission will carry two systems in Shuttle middeck lockers to continue space-based research into the structure of proteins and other macromolecules. Vapor Diffusion Apparatus trays will be housed within a temperature-controlled Thermal Enclosure System, which fills the area normally occupied by two lockers. The Protein Crystallization Apparatus for Microgravity will be housed in a Single-locker Thermal Enclosure System.

Proteins are important, complex biochemicals that serve a variety of purposes in living organisms. Determining the molecular structure of proteins will lead to a greater understanding of how the organisms function. Knowledge of the structures also can help the pharmaceutical industry develop disease-fighting drugs.

X-ray crystallography currently offers the best route to determine the three-dimensional structure of macromolecules, particularly proteins. In this technique, researchers grow crystals of purified proteins, then collect X-ray diffraction data on the crystals. The three-dimensional structure is then determined by analysis of this data. Unfortunately, crystals grown in the gravity environment of Earth often have internal defects that make such analysis difficult or impossible.

As demonstrated on Space Shuttle missions since 1985, some protein crystals grown in space — away from gravity's distortions — are larger and have fewer defects. The experiments help develop techniques and methods to improve the protein crystallization process on Earth as well as in space.

Both systems will grow crystals using the vapor diffusion method, which has been highly effective in previous Shuttle experiments. In vapor diffusion, water evaporates from a protein solution and is absorbed by a more concentrated reservoir solution contained in a wicking material. As the protein concentration rises, the protein crystals form.

Vapor Diffusion Apparatus Experiments

Dr. Larry DeLucas
University of Alabama at Birmingham
Birmingham, AL

This investigation continues a very successful series of space-based protein crystal growth experiments, which has produced some of the highest-quality crystals of several proteins. Previous experiments have helped determine the structures of porcine elastase, used to study emphysema; gamma-interferon, which stimulates the immune system and is used to treat cancer and viral diseases; and Factor D, important in understanding the body's defenses against infection.

On STS-67, the Vapor Diffusion Apparatus experiments will be contained in a Thermal Enclosure System (TES), which is the size of two mid-deck lockers. The TES, set at 72 degrees Fahrenheit (22 degrees Celsius), will contain four vapor diffusion apparatus trays, each containing 20 individual crystallization chambers. Each experiment chamber includes a double-barreled syringe containing protein solution in one barrel and precipitant solution in the other. A reservoir of concentrated precipitant solution is contained in the wicking material lining the experiment chamber.

To activate the experiments at the beginning of the mission, a crew member will turn a ganging mechanism on the side of each tray to push the syringe pistons forward and extrude the protein droplets onto the syringe tip. During the course of the experiments, water molecules will migrate from the drops through the vapor space to the more concentrated reservoirs, increasing the protein and precipitant concentrations in the drops. The increased concentration in the drops will initiate crystal growth. At the end of the mission, the experiments will be deactivated by drawing the protein drops and crystals back into the syringes.

Some of the proteins to be grown in the Vapor Diffusion Apparatus Experiments include:

PROTEIN	AFFILIATION	DESCRIPTION
Pyruvate Kinase	University of Texas Medical Branch at Galveston	Pyruvate kinase is an important control enzyme in the pathway that generates energy from glucose. The three dimensional structure of this enzyme will contribute to the understanding of the function of this important regulatory enzyme.
PEP Carboxykinase	University of Saskatchewan, Saskatoon, Saskatchewan, Canada	This is an important enzyme in the production of glucose from non-carbohydrate sources by living systems. Structural information about this protein will provide insight into the mechanisms of this process.
Mur b	Bristol-Myers Squibb	This protein, a product of the E. coli bacteria, is a potential therapeutic target for the development of new antibiotic

Aldehyde Reductase	University of Alabama at Birmingham	This enzyme has been implicated in diabetic complications of the eyes and the kidneys. Its three-dimensional structure is a key factor in developing inhibitors to the enzyme's damaging activity.
Thaumatin	University of Alabama at Birmingham	Thaumatin is a sweet tasting protein isolated from an African plant. It has commercial potential as a sweetener because of its potency and stability over a wide pH range.
Aminoglycoside Phosphotransferase type III	McMaster Univ. Hamilton, Ontario, Canada	This enzyme phosphorylates a group of antibiotics and renders them clinically ineffective. The three-dimensional structure of the protein will provide information about antibiotic resistance and may aid in designing strategies to circumvent this problem.
HIV-(1)-Protease	Vertex Pharmaceuticals, Inc.	HIV-(1)-Protease is a critical enzyme in the life cycle of the human immunodeficiency virus. It is an important target in the search for a vaccine for HIV and for drug treatments for AIDS.

Protein Crystallization Apparatus for Microgravity
Dr. Daniel Carter
Marshall Space Flight Center
Huntsville, AL

The Protein Crystallization Apparatus for Microgravity (PCAM) is the second test of a new design for growing large quantities of protein crystals in orbit. It first flew aboard STS-63 in February 1995. The apparatus holds more than six times as many samples as are normally accommodated in the same amount of space.

A controlled-temperature enclosure occupying a single Shuttle mid-deck locker, called the Single-locker Thermal Enclosure System (STES), will hold six cylinders containing a total of 378 samples — one of the largest quantities in any single protein crystal growth experiment to date. In most experiments of this type, a single locker accommodated a maximum of 60 samples. The STES will maintain temperatures at 72 degrees Fahrenheit (22 degrees Celsius).

Each cylinder contains nine trays held in position by guide rods and separated from each other by bumper plates with springs. The trays are sealed by an adhesive elastomer. Each tray holds seven sample wells, surrounded by a donut-shaped reservoir with a wicking material to absorb the protein carrier solution as it evaporates.

To start the experiment, a crew member will open the front of the thermal enclosure, then rotate a shaft on the end of the cylinder with a ratchet from an orbiter tool kit. This will allow diffusion to start and protein crystal growth to begin. Near the end of the mission, a crew member will rotate the shaft in the opposite direction to stop diffusion.

A few of the candidate proteins for this flight of the PCAM are human cytomegalovirus assemblin (a factor in virus duplication), parathyroid hormone antagonist (a controlling factor in bone growth), pseudoknot 26 (a potential HIV inhibitor), human antithrombin III (a blood clotting factor), and an HIV protease/drug complex (a factor in viral replication).

MIDDECK ACTIVE CONTROL EXPERIMENT

The Middeck Active Control Experiment (MACE) is designed to study the active control of flexible structures in space. In this experiment, a small, multibody platform will be assembled and free-floated inside the Space Shuttle. Tests will be conducted on the platform to measure how disturbances caused by a payload impacts the performance of another nearby payload which is attached to the same supporting structure.

MACE consists of three separate hardware elements: The Multibody Platform, the Experiment Support Module, and the Ku-Band Interface Unit. The Multibody Platform consists of a long flexible polycarbonate structure. A two axis gimballing payload is located at either end, and a three-axis torque wheel/rate gyro platform is located in the center. By swapping out certain components, the platform can be reconfigured into more complex geometries, thereby increasing the complexity of the control problem. Actuators consisting of 7 motors and two piezoelectric bending elements and sensors, consisting of rate gyros, strain gauges, and encoders, are distributed along the structure to facilitate active control. The Experiment Support Module contains all the electronics necessary to conduct the experiment. The Ku-Band Interface Unit allows downlink and uplink of data from the middeck.

On-orbit, the astronaut will set-up the test article and attach it to the Experiment Support Module. A series of tests will be performed by using a hand-held terminal for selecting and controlling programmed test protocols. The astronaut will monitor the experiment and videotape its operation. At the end of each test day, the astronaut will select several of the test result data files for downlink via the Ku-Band Interface System. The MACE ground team will use this data to adjust the test protocols during the mission. These new protocols will be later uplinked and run on the hardware. MACE is expected to take 44 hours of on-orbit time. Mission Commander Steve Oswald and Pilot William Gregory will operate the hardware on orbit.

MACE is an IN-STEP (In-Space Technology Experiments Program) experiment, sponsored by NASA's Office of Space Access and Technology, that was developed by the Massachusetts Institute of Technology in collaboration with Payload Systems, Inc., NASA's Langley Research Center, and Lockheed Missiles and Space Company. The experiment will provide a fundamental understanding of the effects of microgravity on the interaction between the dynamics of structures and attached payloads and validate control strategies and algorithms that will be applicable to a wide range of future space missions.

Shuttle Amateur Radio EXperiment (SAREX)

Students from 26 schools in the U.S., South Africa, India and Australia will have a chance to speak via amateur radio with astronauts aboard Endeavour during the STS-67 mission. Ground-based amateur radio operators ("hams") will be able to contact the Shuttle through automated computer-to-computer amateur (packet) radio links. There also will be voice contacts with the general ham community as time permits.

Shuttle Commander Stephen S. Oswald (call sign KB5YSR), pilot William G. Gregory, (call sign KC5MGA), mission specialists Tamara E. Jernigan (call sign KC5MGF) and Wendy B. Lawrence (KC5KII) and Payload Specialists Ron Parise (WA4SIR) and Sam Durrance (N3TQA) will talk with the students.

Students in the following schools will have the opportunity to talk directly with orbiting astronauts for approximately 4 to 8 minutes:

- Brewton Elementary School, Brewton, AL (WD4SBV)
- Watson Elementary School, Huntsville, AR (W5TM)
- Fullbright Avenue Elementary, Canoga Park, CA (W6SD)
- Tri City Christian Schools, Vista, CA (KK6FX)
- Plymouth Center School, Plymouth, CT (KD1OY)
- Bishop Planetarium & South Florida Museum, Bradenton, FL (KB4SYV)
- Renfroe Middle School, Decatur, GA (KM4LS)
- Pearl City High School, Pearl City, HI (AH6IO)
- Waihe'e Elementary School, Wailuku, HI (KH6HHG)
- Highland Park H.S., Highland Park, IL (W9MON)
- Kentucky Tech, Montgomery County Area Vocational Education Center, Mt. Sterling, KY (WD4EUD)
- U.S. Naval Academy, Annapolis, MD (W3ADO)
- Lutherville Elementary/Ridgely Middle School, Lutherville, MD (WA3GOV)
- Silver Spring/Burtonsville Schools, Silver Spring, MD (N3CJN)
- William Bryant Elementary, Blue Springs, MO (WA0NKE)
- Plank Road South School, Webster, NY (KB2JDS)
- Lockport H.S., Lockport, NY (N2IQL)
- Saint Peters School, Greenville, NC
- Washington Senior H..S., Washington C.H., OH (N8MNB)
- Bethany Middle School, Bethany, OK (KB5KIJ)
- Tarkington Middle School, Cleveland, TX (N5AF)
- Chisum Jr./Sr. H.S., Paris, TX (KA5CJJ)
- J.J. Fray Elementary School, Rustburg, VA (K4HEX)
- Group of Scholars from South Africa, South Africa (ZS5AKV)
- Little Lillys English School, Bangalore, India (VY2RMS)
- Cobram Secondary College, Cobram, Australia (VK3KLN)

The radio contacts are part of the SAREX project, a joint effort by NASA, the American Radio Relay League (ARRL), and the Radio Amateur Satellite Corp.

The project, which has flown on 15 previous Shuttle missions, is designed to encourage public participation in the space program and support the conduct of educational initiatives to demonstrate the effectiveness of communications between the Shuttle and low-cost ground stations using amateur radio voice and digital techniques.

Several audio and digital communication services have been developed to disseminate Shuttle and SAREX-specific information during the flight.

The ARRL ham radio station (W1AW) will include SAREX information in its regular voice and teletype bulletins.

The amateur radio station at the Goddard Space Flight Center, (WA3NAN), will operate around the clock during the mission, providing SAREX information, retransmitting live Shuttle air-to-ground audio, and retransmitting many SAREX school group contacts.

Information about orbital elements, contact times, frequencies and crew operating schedules will be available during the mission from NASA ARRL (Steve Mansfield, 203/666-1541) and AMSAT (Frank Bauer, 301/286-8496). AMSAT will provide information bulletins for interested parties on the Internet and amateur packet radio.

Current Keplerian elements to track the Shuttle are available from the NASA Spacelink computer information system, computer bulletin board system (BBS) (205) 895-0028 or via the Internet: **spacelink.msfc.nasa.gov.**, and the ARRL BBS (203) 666-0578. The latest element sets and mission information are also available via the Johnson Space Center (JSC) ARC BBS or the Goddard Space Flight Center (GSFC) BBS. The JSC number is (713) 244-5625, 9600 Baud or less. The GSFC BBS is available via Internet. The address is **wa3nan.gsfc.nasa.gov.**

STS-67 SAREX Frequencies

Routine SAREX transmissions from the Space Shuttle may be monitored on a worldwide downlink frequency of 145.55 MHz.

The voice uplink frequencies are (except Europe):
144.91 MHz
144.93
144.95
144.97
144.99

The voice uplink frequencies for Europe only are:
144.70
144.75
144.80

Note: The astronauts will not favor any one of the above frequencies. Therefore, the ability to talk with an astronaut depends on selecting one of the above frequencies chosen by the astronaut.

The worldwide amateur packet frequencies are:

Packet downlink	145.55 MHz
Packet uplink	144.49 MHz

The Goddard Space Flight Center amateur radio club planned HF operating frequencies are:

3.860 MHz	7.185 MHz
14.295	21.395
28.650	

STS-67 CREW BIOGRAPHIES

Stephen S. Oswald, 43, will lead STS-67's seven-member crew, serving as Commander. This is his third space flight.

Selected as an astronaut in 1985. Oswald was born in Seattle, WA, but considers Bellingham, WA, to be his hometown. He received a bachelor of science degree in aerospace engineering from the U.S. Naval Academy in 1973 and was designated as a naval aviator in September 1974. Following training in the A-7 aircraft, he flew the Corsair-II aboard the USS Midway from 1975-1977. In 1978, he attended the U.S. Naval Test Pilot School at Patuxent River, MD. Upon graduation, he remained at the Naval Air Test Center conducting flying qualities, performance and propulsion flight tests on the A-7 and F/A-18 aircraft through 1981.

Oswald resigned from active Navy duty and joined Westinghouse Electric Corp. as a civilian test pilot. During 1983-1984, he was involved in developmental flight testing of various airborne weapons systems for Westinghouse, including the F-16C and B-1B radars. He has logged over 6,000 flight hours in 40 different aircraft.

Oswald joined NASA in 1984 as an aerospace engineer and instructor pilot. Since being selected as an astronaut, he has served as Pilot for STS-42 and STS-56, flown in January 1992 and April 1993, respectively. The International Microgravity Laboratory-1, the primary payload on STS-42, included major microgravity experiments conducted over the eight-day flight in Discovery's Spacelab module. STS-56 was the second Atmospheric Laboratory for Applications and Science mission. This nine-day flight also included the deployment and retrieval of the SPARTAN spacecraft. With the completion of his second mission, Oswald has logged more than 400 hours in space.

William G. Gregory (Lt. Col., USAF), 37, will serve as Pilot for STS-67. This is his first shuttle mission.

Born in Lockport, NY., Gregory received a bachelor of science degree in engineering science from the Air Force Academy in 1979, a master of science degree in engineering mechanics from Columbia University in 1980 and a master of science degree in management from Troy State University in 1984.

Between 1981 and 1986, Gregory served as an operational fighter pilot flying the D and F models of the F-111. In this capacity, he served as an instructor pilot at RAF Lakenheath, U.K., and Cannon Air Force Base, NM. He attended the USAF Test Pilot School in 1987. Between 1988 and 1990, Gregory served as a test pilot at Edwards Air Force Base, flying the F-4, A-7D and all five models of the F-15. He has accumulated more than 3,500 hours of flight time in more than 40 types of aircraft. Gregory was selected for the astronaut corps in 1990.

John M. Grunsfeld, Ph.D., 36, also will be making his first space flight on STS-67. Grunsfeld will serve as Mission Specialist 1.

Grunsfeld was born in Chicago, IL, and received a bachelor of science degree in physics from the Massachusetts Institute of Technology in 1980. He earned a master of science degrees and a doctor of philosophy degree in physics from the University of Chicago in 1984 and 1988, respectively.

Grunsfeld has held a variety of academic positions at institutions including the University of Chicago, California Institute of Technology and the University of Tokyo/Institute of Space and Astronautical Science. His research has covered X-ray and gamma-ray astronomy, high energy cosmic ray studies, and development of new detectors and instrumentation. He also has studied binary pulsars and energetic X-ray and gamma ray sources using NASA's Compton Gamma Ray Observatory, X-ray astronomy satellites, radio telescopes and optical telescopes. Grunsfeld was selected as an astronaut in 1992.

Wendy B. Lawrence, Commander (Select), USN, will serve as flight engineer and will carry the designation Mission Specialist 2 during her first shuttle flight.

Lawrence, 35, was born in Jacksonville, FL, and received a bachelor of science degree in ocean engineering from the U.S. Naval Academy in 1981. She earned a master of science degree in ocean engineering from the Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution in 1988.

Lawrence was designated as a naval aviator in July 1982 and has more than 1500 hours of flight time. She also has conducted more than 800 shipboard landings in six different types of helicopters. While stationed at Helicopter Combat Support Squadron SIX, she was one of the first two female helicopter pilots to make a long deployment to the Indian Ocean as part of a carrier battle group. In October 1990, she reported to the U.S. Naval Academy where she served as a physics instructor. Lawrence is a member of the astronaut class of 1992.

Tamara E. Jernigan, Ph.D., 35, will serve as the Payload Commander and Mission Specialist 3 during her third space flight.

Born in Chattanooga, TN, Jernigan received a bachelor of science degree with honors in physics in 1981, and a master of science degree in engineering science in 1983, both from Stanford University. She earned a master of science degree in astronomy from the University of California-Berkeley in 1985 and earned her doctorate in space physics and astronomy from Rice University in 1988.

After graduating from Stanford, Jernigan served as a research scientist in the Theoretical Studies Branch at NASA's Ames Research Center from June 1981 to July 1985. Her research interests have included the study of bipolar

outflows in regions of star formation, gamma ray bursts and shock wave phenomena in the interstellar medium.

Selected as an astronaut candidate in 1985, Jernigan has held a wide variety of technical assignments including software verification in the Shuttle Avionics Integration Laboratory, operations coordination on secondary payloads, spacecraft communicator for five shuttle flights, lead astronaut for flight software development, and chief of the Astronaut Office Mission Development Branch.

Jernigan's first shuttle flight was STS-40 in June 1991, a nine-day mission called Spacelab Life Sciences-1, the first mission dedicated to investigating how the human body adapted to microgravity. Her second mission, STS-52 in October 1992, was a 10-day flight during which crew members deployed the Laser Geodynamics Satellite and operated the U.S. Microgravity Payload-1. Jernigan has logged about 455 hours in space.

Samuel T. Durrance, Ph.D., 51, will be returning to space for a second time as one of two payload specialists for the ASTRO-2 mission. He first flew in that capacity on the ASTRO-1 mission aboard Columbia on the STS-35 flight in December 1990. Durrance will carry the designation Payload Specialist 1.

Durrance was born in Tallahassee, FL, but considers Tampa, to be his hometown. He earned a bachelor of science and mater of science degrees in physics from California State University, Los Angeles, in 1972 and 1974, respectively. He then received a doctor of philosophy degree in astrogeophysics from the University of Colorado in 1980.

Durrance is a Principal Research Scientist in the Department of Physics and Astronomy at Johns Hopkins University, Baltimore, MD. He is co-investigator for the Hopkins Ultraviolet Telescope, one of the instruments flying as part of the ASTRO Observatory.

Durrance has made International Ultraviolet Explorer satellite observations of Venus, Mars, Jupiter, Saturn and Uranus. He has directed a program to develop adaptive optics instrumentation resulting in the design and construction of the Adaptive Optics Coronagraph, which is now being used at the Palomar Observatory in California. In addition, he participated in the design construction, calibration and integration of the Hopkins Ultraviolet Telescope and the ASTRO Observatory. His main astronomical interests are in the origin and evolution of planets, both in our own solar system and around other stars.

Ronald Parise, Ph.D., rounds out the STS-67 crew as Payload Specialist 2. Parise will be making his second space flight, having first flown during the ASTRO-1 mission in December 1990.

Parise, 43, was born in Warren, OH, and received his bachelor of science degree in physics with minors in mathematics, astronomy and geology from Youngstown State University in 1973. He received a master of science degree

and a doctor of philosophy degree in astronomy from the University of Florida in 1977 and 1979, respectively.

Parise currently is a senior scientist in the Space Observatories Department of Computer Sciences Corporation in Silver Spring, MD. He also is a member of the research team for the Ultraviolet Imaging Telescope, one of the ASTRO-2 instruments. Parise has been involved in all aspects of flight hardware development, electronic systems design and mission planning activities for the Ultraviolet Imaging Telescope. He has studied the circumstellar material in binary star systems using the Copernicus satellite as well as the International Ultraviolet Explorer. His current research involves the study of the later stages of the evolution of low mass stars in globular clusters.

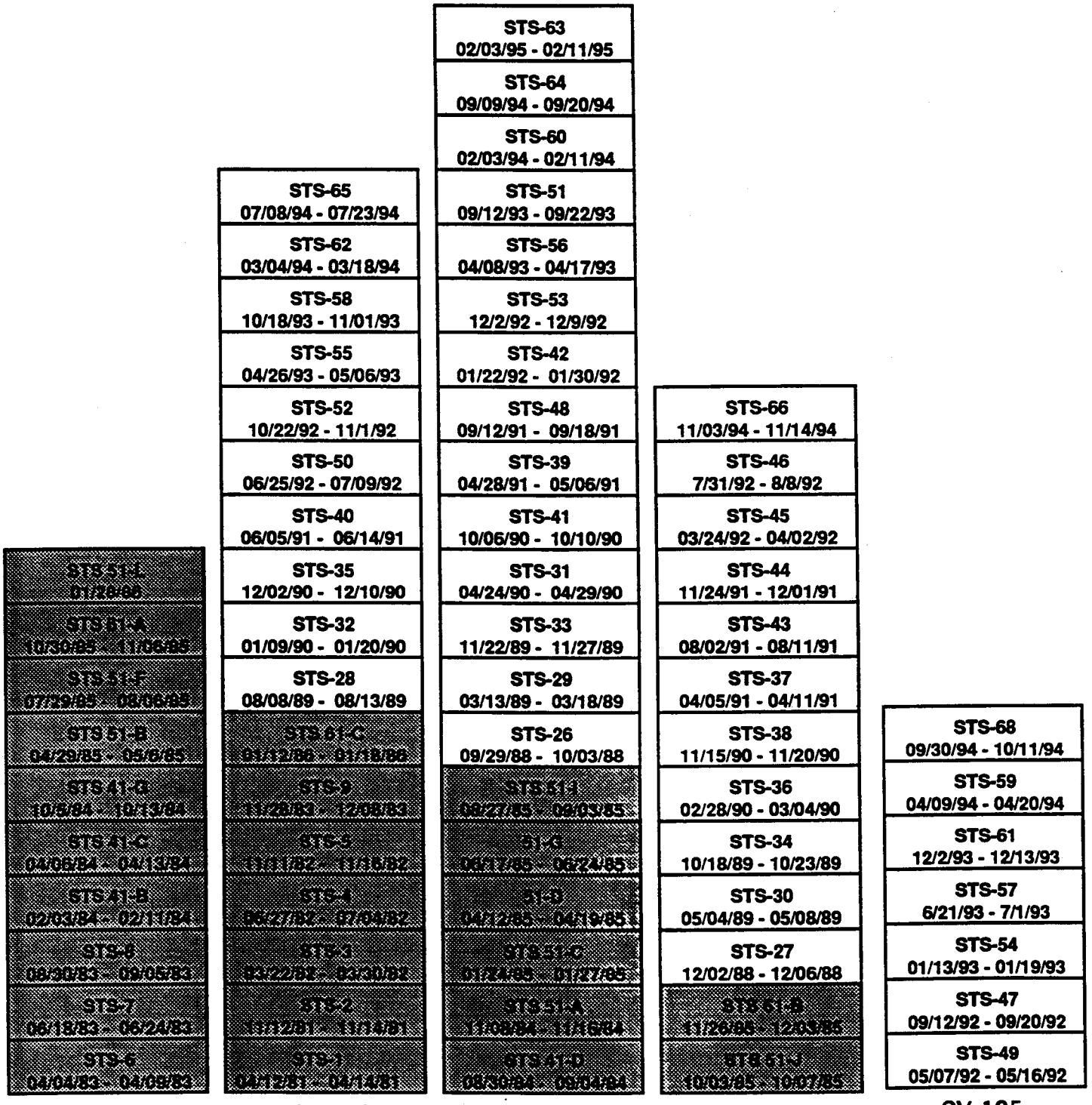
UPCOMING SHUTTLE MISSIONS

MISSION	ORBITER	MAJOR PAYLOADS	TARGET DATE	MISSION DURATION
STS-71	ATLANTIS	Shuttle-Mir Mission-1	JUNE 1995	10+1 Days
STS-70	DISCOVERY	Tracking Data Relay Satellite-G	JUNE 1995	8 Days
STS-69	ENDEAVOUR	Wake Shield Facility-2 SPARTAN-201	AUGUST 1995	11 Days
STS-73	COLUMBIA	U.S. Microgravity Laboratory-2	SEPTEMBER 1995	16 Days
STS-74	ATLANTIS	Shuttle-Mir Mission-2	NOVEMBER 1995	6+1 Days
STS-72	ENDEAVOUR	Space Flyer Unit-Ret OAST-FLYER	DECEMBER 1995	10 Days
STS-75	COLUMBIA	Tethered Satellite System United States Microgravity Payload-3	FEBRUARY 1996	13 Days
STS-76	ATLANTIS	Shuttle-Mir Mission-3	APRIL 1996	10+1 Days

Based on February 1995 Manifest

SHUTTLE FLIGHTS AS OF FEBRUARY 1995

67 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM -- 42 SINCE RETURN TO FLIGHT



Launius, Roger

From: NASANews
To: press-release-nasa
Subject: STS-67 Countdown Briefings/Launch Coverage Feb. 27 - March 2
Date: Friday, February 24, 1995 4:56PM

Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

February 24, 1995

Lisa Malone
Kennedy Space Center, FL
(Phone: 407/867-2468)

NOTE TO EDITORS: N95-11A

STS-67 COUNTDOWN BRIEFINGS/LAUNCH COVERAGE - FEB. 27-MARCH 2

A series of briefings will be held next week at NASA's Kennedy Space Center in connection with the next flight of the Space Shuttle. The STS-67 mission, aboard Space Shuttle Endeavour, a 16-day flight focusing on ultraviolet astronomy, is scheduled for launch next Thursday, March 2 at 1:37 a.m. EST.

Beginning three days before launch, daily countdown status briefings will be held to update news media on final processing activities on Endeavour and the STS-67 payloads. On Feb. 28, there will be a briefing on the commercial experiments aboard Endeavour and a pre-launch news conference with senior NASA managers who will discuss mission readiness and flight objectives. On March 1, NASA TV will replay the STS-67 pre-flight briefings that were held at Johnson Space Center, Houston, and Marshall Space Flight Center, Huntsville, AL, on Feb. 16.

News media should take note that the daily news video feeds will continue at their regularly scheduled release time of 12 noon EST. Video advisories on the content of each day's feed will be issued in the normal manner.

Attached is a listing of the times, subjects and participants for each of the scheduled briefings. Also noted on the schedule are key STS-67 pre-launch activities and NASA TV replays.

- end -

STS-67 PAO BRIEFINGS & EVENTS - ALL TIMES EASTERN

(Based on March 2, 1995 launch date)

* *

Launch - 4 Days - Sunday, Feb. 26, 1995

10:30 p.m. STS-67 Crew Arrival at KSC Shuttle Landing Facility (SLF)

* *

LAUNCH - 3 DAYS - Monday, Feb. 27, 1995

2:00 a.m. Begin STS-67 launch countdown

5:00 a.m. Replay of STS-67 crew arrival at KSC SLF

9:00 a.m. Countdown Status
Moderator: KSC PIO
Briefers: Bill Dowdell, Shuttle Test Director
Glenn Snyder, KSC STS-67 Payload Manager
John Weems, Shuttle Launch Weather Officer

12:00 p.m. Daily Video Newsfeed

* *

LAUNCH - 2 DAYS - Tuesday, Feb. 28, 1995

9:00 a.m. Countdown Status
Moderator: KSC PIO
Briefers: Debbie Frostrom, NASA Test Director
Glenn Snyder, KSC STS-67 Payload Manager
John Weems, Shuttle Launch Weather Officer

9:15 a.m. CMIX Briefing
Moderator: Jim Cast
Briefers: Jennifer Eroskey, CMIX Program Mgr., NASA HQ, OSAT
Dr. Marian Lewis, CMIX Project Mgr., Univ. of Alabama/Huntsville
John Cassanto, President, Instrumentation Technology Associates

10:00 a.m. Black History Month Event w/ Dr. Bernard Harris (from JSC)

12:00 p.m. Daily Video Newsfeed

3:00 p.m.* Pre-Launch Press Conference
Moderator: Lisa Malone
Briefers: Dr. Edward Weiler, Chief, Ultraviolet & Visible Astrophysics Branch, NASA HQ
Brewster Shaw, Space Shuttle Program Director, JSC
Bob Sieck, Director, Shuttle Management & Operations, KSC
Capt. David Biggar, Air Force Staff Meteorologist

* *

*Note: Time for pre-launch press conference may change depending on L-2 Mission Management Team meeting schedule. Please check with KSC PAO for update on time for press conference.

LAUNCH - 1 / LAUNCH DAY - Wednesday/Thursday, March 1-2

9:00 a.m. Countdown Status
Moderator: KSC PIO

Briefers: Kelvin Manning, NASA Test Director
Glenn Snyder, KSC STS-67 Payload Manager

9:15 a.m. Replay of STS-67 Pre-Flight Briefings
(held 2/16/95)

12:00 p.m. Daily Video Newsfeed

1:00 p.m. Continue Replay of STS-67 Pre-Flight Briefings

9:00 p.m.. Begin STS-67 Launch Countdown Television Coverage

1:37 a.m. Launch of Space Shuttle Endeavour

2:30 a.m. Post-Launch Press Conference
Moderator: Lisa Malone
Briefers: Loren Shriver, Mgr., Launch Integration, Space Shuttle Prog., KSC
James Harrington, KSC Launch Director

* *

All times listed are EST.

Launius, Roger

From: NASANews
To: press-release-nasa
Subject: NASA to Announce Discovery Mission Selections
Date: Friday, February 24, 1995 4:56PM

Doug Isbell
Headquarters, Washington, DC
(Phone: 202/358-1753)

February 24, 1995

NOTE TO EDITORS: N95-12

NASA TO ANNOUNCE DISCOVERY MISSION SELECTIONS

NASA will announce new selections for missions in the Discovery program, a low-cost approach to Solar System exploration, in a news conference to be held at 11 a.m. EST Feb. 28. The news conference will originate from the NASA Headquarters auditorium, 300 E St. SW, Washington, DC.

Dr. Wesley T. Huntress, Jr., NASA Associate Administrator, Office of Space Science, will announce the selection of one mission for immediate flight opportunity, and the selection of three additional missions for further evaluation leading to a second flight opportunity.

The briefing will be carried live on NASA Television with two-way question and answer capability from participating centers.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

Kyle Herring
Johnson Space Center, Houston
(Phone: 713/483-5111)

February 27, 1995

NOTE TO EDITORS: N95-13

NASA WELCOMES NEW ASTRONAUT CLASS OF 1995

Twenty-one astronaut candidates will arrive at the Johnson Space Center (JSC) March 6 to begin a year of familiarization training. The ten pilot and nine mission specialist candidates selected by NASA in December 1994 will be joined by two international mission specialists.

Badged news media are invited to meet the group at 4 p.m. EST, March 6, in the mockup facility (Building 9) at JSC. This will be the only availability of the candidates until the year-long training program is completed.

The following is background information on the astronaut candidates.

Pilots:

Scott D. Altman, Lt. Cdr., USN, 35, was born in Lincoln, IL, and resides in San Diego, CA. His masters degree in aeronautical engineering was earned in 1990 from the Naval Postgraduate School. At the time of his selection, Altman was an Operations Officer for Fighter Squadron 31 at the Naval Air Station, Miramar in San Diego.

Jeffrey S. Ashby, Commander, USN, 40, was born in Dallas, TX, and resides in Lemoore, CA. He earned a masters degree in aviation systems from the University of Tennessee in 1976. Before his selection, Ashby was commanding officer for Strike Fighter Squadron 94 at the Naval Air Station at Lemoore, CA.

Michael J. Bloomfield, Major, USAF, 35, was born in Flint, MI, and resides at Edwards Air Force Base, CA. He earned a masters in engineering management from Old Dominion University in Virginia, in 1993. Before his selection as an astronaut candidate, Bloomfield was flight commander for the 416th Flight Test Squadron at Edwards AFB, CA.

-more-

Joe F. Edwards, Jr., Lt. Cdr., USN, 37, was born in Richmond, VA and resides in Fairfax, VA. His masters in aviation systems from the University of Tennessee was earned in 1994. Edwards was an operations officer for the Joint Staff at the Pentagon in Washington, DC, before his selection.

Dominic L. Gorie, Commander, USN, 37, was born in Lake Charles, LA, and resides in Orange Park, FL. He earned a masters degree in aviation systems from the University of Tennessee in 1990. Gorie comes to NASA from the Naval Air Station at Cecil Field, FL, where he was a F/A-18 pilot in Strike Fighter Squadron 106.

Rick D. Husband, Major, USAF, 34, was born in Amarillo, TX, and comes to NASA from Amesbury, England. He earned a masters degree in mechanical engineering from California State University in 1990. Husband has been chief of flight test for the Tornado GR1 Exchange Program with the Royal Air Force at Boscombe Down, England.

Steven W. Lindsey, Major, USAF, 34, was born in Arcadia, CA, and resides in Niceville, FL. His masters in aerospace engineering from the Air Force Institute of Technology was earned in 1990. Prior to his selection, Lindsey was a test pilot in the Air Force Seek Eagle Office at Eglin Air Force Base, FL.

Pamela A. Melroy, Major, USAF, 33, was born in Palo Alto, CA, and resides at Edwards Air Force Base, CA. She earned a masters degree in Earth and planetary sciences from the Massachusetts Institute of Technology in 1984. Melroy was a C-17A developmental test pilot at Edwards AFB before her selection.

Susan L. Still, Lieutenant, USN, 33, was born in Augusta, GA, and resides in Virginia Beach, VA. She earned a masters degree in aerospace engineering from the Georgia Institute of Technology in 1985. Prior to her selection, Still was an F-14 pilot in Fighter Squadron 101 at the Naval Air Station Oceana, Virginia Beach, VA.

Frederick W. Sturckow, Captain, USMC, 33, was born in La Mesa, CA, and resides in Leonardtown, MD. His bachelor of science degree in mechanical engineering from California Polytechnic State University was earned in 1984. Before being selected to be an astronaut candidate, Sturckow was an F/A-18 E/F project pilot at the Naval Air Test Center at Patuxent River, MD.

Mission Specialists:

Michael P. Anderson, Major, USAF, 35, was born in Plattsburgh, NY. He earned a masters degree in physics from Creighton University in 1990. Prior to his

selection, Anderson was a Tactics Officer in the 380 Operations Support Squadron at Plattsburgh Air Force Base, NY.

Kalpana Chawla, Ph.D., 33, was born in Karnal, India, but resides in Sunnyvale, CA. She earned her masters from the University of Texas in 1984 and her doctorate from the University of Colorado in 1988, both in aerospace engineering. Prior to joining NASA, Chawla served as a research scientist and vice president for Overset Methods, Inc., in Los Altos, CA.

Robert L. Curbeam, Jr., Lt. Cdr., USN, 33, was born in Baltimore, MD, and resides in Annapolis. He holds a masters degree in aeronautical engineering from the Naval Postgraduate School in 1990 and a degree in aeronautical and astronautical engineering from the same school in 1991. Curbeam was an instructor at the Naval Academy at the time of his selection.

Kathryn P. Hire, 35, was born in Mobile, AL, but resides in Merritt Island, FL. Her masters in space technology is from the Florida Institute of Technology in 1991. Hire comes to NASA from the Kennedy Space Center, FL, where she was a supervisor for Orbit Mechanisms and Swing Arms for the Lockheed Space Operations Company.

Janet L. Kavandi, Ph.D., 35, was born in Springfield, MO, but resides in Renton, WA. She earned her doctorate in chemistry from the University of Washington in 1990. Kavandi joins NASA after serving as a principal engineer for energy storage at the Boeing Defense and Space Group in Seattle, WA.

Edward T. Lu, Ph.D., 31, was born in Springfield, MA, but resides in Honolulu, HI. He earned his doctorate in applied physics from Stanford University in 1989. Prior to his selection by NASA, Lu was a postdoctorate fellow, Institute for Astronomy at the University of Hawaii-Manoa in Honolulu, HI.

Carlos I. Noriega, Major, USMC, 35, was born in Lima, Peru, but is stationed at Camp Foster at Okinawa, Japan. He earned two masters degrees from the Naval Postgraduate School in 1990 -- one in computer science and one in space systems operations. Before coming to NASA, Noriega was a G1 operations officer in the 1st Marine Aircraft Wing at Camp Butler in Okinawa, Japan.

James F. Reilly, 40, was born at Mountain Home Air Force Base, ID, but resides in Mesquite, TX. He earned a masters degree in geosciences from the University of Texas-Dallas in 1987 and is expected to earn a doctorate in geosciences this year from the same school.

Stephen K. Robinson, Ph.D., 39, was born in Sacramento, CA, and resides in Grafton, VA. His doctorate in mechanical engineering is from Stanford University in 1991. Robinson was a research scientist in the Fluid Dynamics & Acoustics Division, at NASA's Langley Research Center in Hampton, VA.

Canadian Space Agency (CSA)

David R. Williams, M.D., 40, was born in Saskatoon, Saskatchewan. He earned a doctorate of medicine and a master of surgery from McGill University in 1983.

National Space Development Agency of Japan (NASDA)

Takao Doi, Ph.D., 40, was born in Minamitama-gun, Tokyo, Japan. He earned a master of engineering degree in 1980, and a doctorate in aerospace engineering in 1983, both from the University of Tokyo, Japan.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Mark Hess
Headquarters, Washington, DC
(Phone: 202/358-1778)

March 1, 1995

Lisa Malone
Kennedy Space Center, FL
(Phone: 407/867-2468)

RELEASE: C95-c

DELAWARE NORTH PARKS SERVICE SELECTED FOR NEGOTIATION TO OPERATE KSC PUBLIC VISITOR PROGRAM

Kennedy Space Center Director Jay Honeycutt has selected Delaware North Parks Service, Buffalo, NY, for negotiations leading to the award of a concession agreement to operate Kennedy Space Center's Public Visitor Program and the facilities of Spaceport USA.

The three companies that submitted bids in October of last year for the concession agreement included Delaware North Parks Service, The Bionetics Corporation, Hampton, VA, and TW Recreational Services, Spartanburg, SC, the incumbent concessioner.

Delaware North Parks Service will manage and operate Spaceport USA and conduct a variety of educational and information programs, including providing tours of Kennedy Space Center and portions of Cape Canaveral Air Station.

Spaceport USA attracts the largest attendance of any NASA visitor center and ranks as one of Florida's top attractions. In 1994, an estimated 2.1 million people visited Spaceport USA. Entirely self-supported, Spaceport USA's gross revenues totaled about $35 million last year. No appropriated funds are used to operate the visitor's center.

NASA expects to enter into a new concession agreement covering a 10-year period beginning May 1, 1995, with an option to extend for one 5-year period.

-more-

TW Recreational Services has served as the concessioner since 1967 when the first public tour was given. What began with a small trailer and one tour bus has blossomed over the years and now encompasses a rocket garden, an art gallery, many educational exhibits, several theaters including two large-format IMAX screens, a full-size Space Shuttle mock-up, tour buses, the astronaut memorial, eateries and a large souvenir store.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

Video Advisory

National Aeronautics and
Space Administration
Washington, DC 20546
(202) 358-1600

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

For Release

March 1, 1995

VIDEO ADVISORY: V95-25

LIVE COVERAGE OF SPACE SHUTTLE ENDEAVOUR LAUNCH ON NTV TONIGHT

NASA TV will provide live coverage starting at 9 p.m. EST tonight of the launch of Space Shuttle Endeavour, due to lift off from the Kennedy Space Center, FL, at 1:37 a.m. EST. The STS-67 ASTRO-2 mission of Endeavour will take a crew of seven into orbit for the longest flight of a Space Shuttle -- 16 days -- on a mission to study the universe using space based astronomy and microgravity research equipment. Starting this evening, NASA TV will provide 24 hour coverage of the STS-67 mission. Daily video news feeds will resume after the landing of Endeavour.

STS-67 Mission Information Contacts:

Kennedy Space Center Newsroom	407/867-2468	(launch, landing)
Johnson Space Center Newsroom	713/483-5111	(mission control)

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

MISSION INFORMATION AVAILABLE VIA THE INTERNET:

Mission television schedules, updated daily, are available via the Internet. The address is FTP.HQ.NASA.GOV. Change directories to PUB/PAO/STATRPT/JSC/**TVSKED**. The STS-67 press kit is available via the Internet at FTP.HQ.NASA.GOV in the PUB/PAO/**PRESSKIT/1995** directory as "**STS-67_PRESS_KIT.txt**" During the ASTRO-2 mission, a World Wide Web home page providing schedules of mission events, video and audio clips, crew photos and biographies, a virtual reality simulation of Endeavour's payload bay, real time mission updates and a velocity and period calculator for the Orbiter will be available to the public at URL: **http://astro-2.msfc.nasa.gov** In addition to the ASTRO-2 home page, the NASA Headquarters Newsroom maintains a World Wide Web home page offering visitors access to media resources concerning ongoing agency activities. The Headquarters Newsroom URL is: **http://www.nasa.gov/hqpao/newsroom.html**

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Terri Hudkins
Headquarters, Washington, DC
(Phone: 202/358-1977)

March 1, 1995

RELEASE: 95-21

NEW VIDEODISC WILL HELP STUDENTS LEARN EARTH SCIENCES

NASA, WGBH-TV, Boston, and Scholastic, Inc., New York, have released an interactive videodisc that gives students and teachers a new perspective on planet Earth. *Interactive NOVA: Earth*, the fourth videodisc from a series based on WGBH's award-winning television program, shows the Earth's system in action using the power of videodiscs and computers.

Interactive NOVA: Earth addresses "What makes the Earth a good home?" To explore the question, students and teachers take electronic field trips to the upper reaches of the Arctic Circle, the heights of Mt. Kilimanjaro, and the depths of a volcano to find clues of how life began on Earth.

The concept of examining the Earth as a single, complex environmental system -- called Earth system science -- involves studying the relationships and sciences involved in water cycles, oxygen, food, photosynthesis, soil conservation, ozone and temperature variances, and global climate patterns. NASA's Mission to Planet Earth is a long-term program to use spacecraft, aircraft and ground teams to study Earth system science.

Former NASA Astronaut Dr. Kathryn Sullivan, Chief Scientist of the National Oceanic and Atmospheric Administration, introduces the program and hosts the video field trips to some of the most remote locations on Earth allowing teachers and students to explore Earth system science using dozens of innovative lesson plans, experiments and hands-on activities.

"*Interactive NOVA: Earth* will provide teachers with an exciting tool for use in their efforts to prepare students for the 21st Century," said Frank Owens, Director of NASA's Education Division. "Technology provides a powerful medium to translate NASA's research results from programs such as Mission to Planet Earth to formats useful to the education community."

The collaborative effort began in March 1992 and has included the contributions of a diverse team of teachers, curriculum specialists, scientists, and other educators.

-more-

NASA, through the Offices of Mission to Planet Earth and Human Resources and Education, contributed to this effort by providing data, visualizations, and other video resources as well as by actively participating in the content development through the involvement of key Agency researchers.

Interactive NOVA: Earth reflects NASA's commitment to supporting education reform and the achievement of the emerging National Science Education Standards by creating high-quality, affordable interactive learning tools and environments.

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Barbara Selby
Headquarters, Washington, DC
(Phone: 202/358-1983)

March 8, 1995

Mary Ann Peto
Lewis Research Center, Cleveland, OH
(Phone: 216/433-2902)

RELEASE: C95-d

NASA AWARDS CONTRACT TO ANALEX CORP.

NASA's Lewis Research Center, Cleveland, OH, has awarded a contract to the Analex Corp., Brookpark, OH, to provide aerospace research and development support services.

The cost-plus-fixed fee contract award is estimated at $174 million over a maximum of five and one-half years. Work will begin on April 1, 1995, and will be performed at the company's facility on the west side of Cleveland.

The contract will encompass a broad range of tasks including technical support for microgravity science and technology, space flight systems, aerospace technology and aeropropulsion technology. Work will include engineering and operations support, manufacturing and inspection services and related administrative support.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Laurie Boeder
Headquarters, Washington, D.C.
(Phone: 202/358-1898)

March 8, 1995

RELEASE: 95-22

MOBLEY NAMED NASA CHIEF ENGINEER

David H. Mobley has begun his duties as NASA Chief Engineer, NASA Headquarters, Washington. Mobley will serve in the position under a rotational assignment.

The Chief Engineer will report directly to the Administrator and will be responsible for overall review of the technical readiness and execution of all NASA programs. The Chief Engineer ensures that the development efforts and NASA mission operations are being planned and conducted on a sound engineering basis with proper programmatic controls. The Chief Engineer also provides an integrated focus for agencywide engineering policies, standards, and practices.

Mobley has been serving as Technical Assistant to the Center Director for space station activities at the Marshall Space Flight Center, Huntsville, AL. He also is a technical advisor to the Space Station program manager at the Johnson Space Center, Houston, and has been tasked with establishing an advance NASA Liaison Office in Moscow.

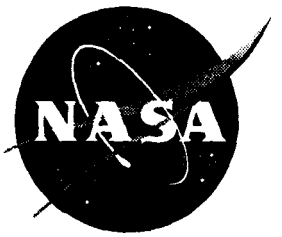
Mobley received a bachelor of science degree in electrical engineering from Auburn University in 1961. He joined NASA in 1961 as a test engineer working on Saturn launch vehicles at Marshall. He went on to work on the Apollo Telescope Mount, a major component of the Skylab Project, and also worked at the Kennedy Space Center, FL, as part of the launch preparation team for Skylab. In 1976, Mobley was part of a technical support team NASA sent to Holland to work with the European Space Agency. In 1984, Mobley was named Spacelab Chief Engineer. In 1988, he was assigned as the deputy manager of the Solid Rocket Module Project Management Office at Marshall. He later became Space Station Freedom Chief Engineer for Work Package One. In 1993, Mobley became a member of the Space Station Redesign Team. Mobley has been instrumental in discussions with the Russian Federation since their joining the international Space Station project in 1994.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600



For Release

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

March 8, 1995
4:00 p.m. EST

Dom Amatore
Marshall Space Flight Center, AL
(Phone: 205/544-6533)

Release: 95-23

X-33, X-34 CONTRACTORS SELECTED FOR NEGOTIATIONS

NASA has selected four companies to enter into negotiations for two rockets which could evolve into the first new launch systems developed by the United States since the advent of the Space Shuttle.

The fast-track X-33 and X-34 programs will feature innovative government/industry partnerships that could lead to workhorse, reusable launch systems for the early 21st century.

The three X-33 selectees are: Lockheed Advanced Development Co., Palmdale, CA; McDonnell Douglas Aerospace, Huntington Beach, CA; and Rockwell International Corporation, Space Systems Division, Downey, CA. The X-34 selectee is Orbital Sciences Corporation, Dulles, VA.

"The innovative 'fast track' procurement process resulting in these selections is a true harbinger of how the 21st-Century 'faster, better, cheaper' NASA intends to conduct its business," said NASA Administrator Daniel S. Goldin. "Within a two month period, X-33 and X-34 Cooperative Agreement Notices were issued, proposals were submitted, and selections made."

The goal of NASA's Reusable Launch Vehicle (RLV) technology program is to enable significant reductions in the cost of access to space to promote the creation and delivery of new space services and other activities that will improve U.S. economic competitiveness. The program will implement the National Space Transportation Policy, issued by the White House in 1994, and will accelerate the development of new space launch technologies and concepts to contribute to the continuing commercialization of the national space launch industry.

-more-

X-33

Phase I, or the concept definition and design phase of the X-33, will be co-funded by the Government and the three contractors. Total funding provided by the Government will be $24 million during the fifteen months of Phase I.

Each participant in Phase I will develop its total X-33 business investment strategies, operations planning and vehicle design and analysis with enough detail to permit competitive selection of an industry partner or partners and their X-33 design concept(s) at the end of Phase I.

The results of Phase I will provide the basis for an Administration decision on whether to proceed with Phase II, which includes design, building and flight demonstration of the X-33, and would continue through the end of the decade.

The results of Phase II would be used by the Government and private sector to decide whether to proceed with development of an operational next generation reusable launch system.

X-34

The X-34 booster will demonstrate streamlined management techniques and advanced technologies that have application to future reusable launch vehicle systems. It also may have potential application to commercial launch vehicle capabilities and will provide significantly reduced mission costs for placing small payloads into low Earth orbit.

The development schedule will support flight tests beginning in late-1997, orbital launch by mid-1998 and test bed applications later in 1998. The current expected NASA program funding for the X-34, through Fiscal Year 1999, is $70 million. Cost-sharing contributions will match on a cumulative basis, as a minimum, the NASA funds provided directly to the offerer under the resulting Cooperative Agreement.

NASA's Office of Space Access and Technology (OSAT) conducts space research and development through sponsorship of technology programs conducted at NASA field centers, in U.S. industry, and in American universities. The OSAT Space Transportation Division supports these activities by sponsoring the development of the next generation reusable launch vehicle technologies. Marshall Space Flight Center is the host center for the X-33 and X-34 programs.

- end -

An RLV World Wide Web Site with information about the program is available over the Internet. The URL is: ***http://rlv.msfc.nasa.gov/rlv_htmls/rlv1.html***

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

March 10, 1995

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Diane Farrar
Ames Research Center, Mountain View, CA
(Phone: 415/604-9000)

RELEASE: 95-24

U.S. INSTRUMENTS TO FLY ABOARD JAPANESE ASTRONOMY MISSION

Several NASA-built components of the Infrared Telescope in Space (IRTS), the first Japanese orbiting telescope dedicated to infrared astronomy, will be launched aboard Japan's Space Flyer Unit (SFU) on March 15 from Japan.

The SFU platform will be launched into low-Earth orbit from the Tanegashima Space Center in Japan aboard NASDA's H-II rocket and retrieved by the Space Shuttle later this year. After several days of systems checks, SFU will be boosted by onboard rockets to a 500 km (311 mile) circular orbit.

The SFU was developed jointly by Japan's Institute of Space and Astronautical Science (ISAS), the National Space Development Agency (NASDA) of Japan, and Japan's Ministry of International Trade and Industry (MITI).

The IRTS will survey about ten percent of the celestial sky during its three-week mission. Its lifetime is limited by the amount of onboard refrigerant necessary to cool the telescope. During operations, IRTS will be cooled to a temperature of -455 degrees Fahrenheit to provide high-sensitivity observations of thermal infrared radiation. Once the liquid helium coolant is depleted, IRTS will stop operating and other experiments aboard SFU will be conducted.

IRTS consists of a 15-cm diameter telescope and four scientific instruments designed and built to study infrared radiation at wavelengths between approximately 1-1000 microns (one-millionth of a meter). The orbiting observatory will provide measurements of the interstellar matter -- the dust and gas -- in the disk of our galaxy and the interplanetary dust within our solar system. It also will yield new information about cool stars and cosmology, the study of the large-scale structure and evolution of the Universe.

-more-

U.S. scientists, in collaboration with Japanese colleagues, built two of the four IRTS instruments. Dr. Thomas Roellig, an astrophysicist at the NASA Ames Research Center, Moffett Field, CA, is co-Principal Investigator for the Mid-Infrared Spectrometer (MIRS). The MIRS instrument, developed in collaboration with Dr. Takashi Onaka of the University of Tokyo, will provide spectroscopic measurements at wavelengths between about 5 and 12 microns -- radiation that is about ten times longer than visible light. MIRS will study molecular gas in the Milky Way and infrared emission from the dust within our solar system.

Historically, many astronomical discoveries have been made when instrument sensitivities were increased by a factor of ten or more. The two-pound MIRS instrument will provide measurements that are "100-1000 times more sensitive than anything that has been measured in this wavelength before," said Roellig. "I expect that the most exciting discoveries will be unexpected ones," he said.

Dr. Andrew Lange, now at the California Institute of Technology, built the Far-Infrared Photometer (FIRP) instrument while at the University of California, Berkeley. Built in collaboration with colleagues at Nagoya University, FIRP will perform imaging at four far-infrared and submillimeter bands between 150 and 700 microns. FIRP will study interstellar dust, variations in cosmic background radiation, and extragalactic submillimeter radiation. FIRP will provide important new information about cosmology and will follow-up earlier discoveries made by the IRAS and COBE satellites.

Ground tracking support for the IRTS mission will be provided by the Kagoshima Space Center, Japan, and NASA's Deep Space Network, with its antennas at Goldstone (California), Canberra (Australia), and Madrid (Spain). Science operations will be conducted at Sagamihara Operations Center, Japan.

After IRTS investigators process and calibrate the science data, it will be made available to the general astronomical communities in Japan and the U.S. The Jet Propulsion Laboratory, Pasadena, CA, will serve as the U.S. archive site for the data. Funding for the two U.S. instruments was provided by the Astrophysics Division, NASA Headquarters, Washington, DC.

The SFU is scheduled to be captured in-orbit by the Shuttle Endeavour during mission STS-72, scheduled for December 1995, whose crew is expected to include a Japanese mission specialist astronaut, Koichi Wakata.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Ed Campion/Ray Castillo
Headquarters, Washington, DC
(Phone: 202/358-1778)

Kyle Herring
Johnson Space Center, Houston
(Phone: 713/483-5111)

March 10, 1995

RELEASE: 95-25

ASTRONAUT BAKER TO REPLACE SEGA AS NASA MANAGER IN RUSSIA

Astronaut Michael A. Baker (Captain, USN), will replace Ronald M. Sega, Ph.D., as the NASA manager of operational activities at Star City, Russia, near Moscow. The transition coincides with the launching March 14 of Norman E. Thagard and two cosmonauts aboard a Soyuz rocket for a three-month stay aboard Russia's space station Mir.

As Director of Operations, Russia, Baker will support training and preparations of NASA astronauts at the Gagarin Cosmonaut Training Center (GCTC), Star City. He also will be the primary interface between NASA and the GCTC management, coordinating all training and other operations including NASA or contractor personnel in Star City.

Baker, the fourth astronaut to serve in this rotational assignment, will continue to establish operational and personal relationships with Star City management and the cosmonauts, which are pivitol to successful, long-term joint operations involving NASA, the Russian Space Agency (RSA) and GCTC. He also will participate in personal training designed to acquaint astronauts with the operational aspects of Russian vehicles and training facilities.

Baker will join fellow astronauts Shannon W. Lucid, Ph.D., and John E. Blaha (USAF Colonel, Ret.) who have been training in Star City since February as the prime and backup crew members for a five-month flight aboard Mir. Lucid will be launched aboard Atlantis' STS-76 mission in the spring of 1996. It will be the third Shuttle mission to dock with the Russian space station.

-more-

Baker, 41, has flown three times on the Shuttle -- STS-43 in August 1991, STS-52 in October 1992, and most recently on STS-63 in September/October 1994. He received a bachelor of science degree in aerospace engineering from the University of Texas in 1975.

Sega, 42, flew on Discovery's STS-60 mission in February 1994, the first joint U.S./Russian Space Shuttle mission. He has served in Star City since November 1994 and will return to an assignment in the Astronaut Office at the Johnson Space Center. Sega received a doctorate in electrical engineering from the University of Colorado in 1982.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Douglas Isbell
Headquarters, Washington, DC
(Phone: 202/358-1753)

March 10, 1995

Diane Ainsworth
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE: 95-26

ULYSSES SPACECRAFT TO MAKE CLOSEST APPROACH TO SUN

The Ulysses spacecraft will pass within 124 million miles (200 million kilometers) of the Sun at 3:40 a.m. Pacific Standard Time (11:40 Universal Time), March 12, the closest it has ever been or ever will be to the Sun since it was launched on October 6, 1990.

Its distance from Earth at perihelion, or closest approach to the Sun, will be approximately 215 million miles (346 million kilometers), said Donald Meyer, Ulysses deputy mission operations manager at NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA.

Ulysses is crossing rapidly into the Sun's northern hemisphere, traveling at a rate of about 0.8 degrees in solar latitude per day and a velocity of approximately 73,000 miles per hour (117,000 kilometers per hour) with respect to the Sun.

For the last month the spacecraft has been collecting data on the equatorial region of the Sun. This effort will continue for the next month, until Ulysses begins to see features from the northern hemisphere of the Sun, said Peter Beech, Ulysses mission operations manager for the European Space Agency (ESA).

All spacecraft operations and science experiments continue to go well. A radio science experiment is currently underway to measure the electron content of the Sun's fiery outer atmosphere, called the corona, as Ulysses passes in back of the Sun as seen from Earth.

The spacecraft's S-band transmitter was turned on February 22 to take advantage of Ulysses' unique position in space to conduct the radio experiment. This transmitter, in conjunction with the X-band transmitter, will be beaming signals through the corona to provide measurements of the electron content through March 15.

-more-

As Ulysses crosses into the northern hemisphere of the heliosphere -- the region of space dominated by the forces of the solar wind -- it will begin its next phase of the primary mission to study that region at all solar latitudes. This phase will be highlighted when Ulysses reaches 70 degrees north of the Sun's equator in June and begins a four-month pass over a second region of the Sun never before explored, as it did with the Sun's southern hemisphere.

During earlier phases of the mission, Ulysses mission scientists found that the solar wind in the Sun's polar regions flows at about two million miles per hour (750 kilometers per second), nearly twice the velocity measured at lower solar latitudes. They also reported that cosmic ray intensity at high latitudes increased, but not nearly to the extent predicted.

The Ulysses mission, managed jointly by NASA and ESA, was designed to study the regions above the Sun's poles. JPL manages the U.S. portion of the mission for NASA's Office of Space Science, Washington, DC.

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

March 14, 1995

Mark Hess/Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

Lisa Malone
Kennedy Space Center, FL
(Phone: 407/867-2468)

NOTE TO EDITORS: N95-14

IN-FLIGHT PRESS CONFERENCE WITH ASTRONAUT NORM THAGARD ABOARD RUSSIAN MIR STATION SET FOR MARCH 20

NASA astronaut Norman E. Thagard and Russian cosmonauts Vladimir Dezhurov and Gennadiy Strekalov will conduct an in-flight press conference aboard the Russian Mir space station on Monday, March 20.

The three men, who are designated as the Mir-18 crew, began their space flight earlier today at the Baikonur Cosmodrome in central Asia when they were launched aboard a Soyuz rocket.

The in-flight press conference is scheduled to begin at 9:58 a.m. EST and is scheduled to last approximately 40 minutes. The two sites for news media to particiapte in the press conference will be the Mission Control Center, Kaliningrad, outside of Moscow, and NASA's Kennedy Space Center, FL. News media wishing to participate in the press conference from Kennedy should contact the KSC Public Affairs Office at 407/867-2468 no later than close-of-business Friday, March 17. Due to limited time available for the event and translation requirements, it is unlikely that all reporters will be able to address a question to the Mir-18 crew.

The press conference will be carried on NASA Television, broadcast on Spacenet-2, transponder 5, channel 9, at 69 degrees West longitude, frequency 3880.0 Mhz, audio 6.8 Megahertz.

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Ray Castillo
Headquarters, Washington, DC
(Phone: 202/358-4555)

March 15, 1995

Brian Welch
Headquarters, Washington, DC
(Phone: 202/358-1600)

RELEASE: 95-27

SHUTTLE MANAGEMENT REVIEW TEAM ISSUES FINAL REPORT

A team of aerospace executives headed by former Johnson Space Center Director Christopher Kraft has recommended that NASA modify the Space Shuttle program's management structure.

The report to NASA Administrator Daniel S. Goldin recommends separating developmental activities from flight operations and suggests that NASA should "relinquish the majority of the operational responsibility to a prime contractor."

The team was formed by Goldin in November 1994 to provide independent recommendations to supplement a comprehensive internal review of the Space Shuttle program. Goldin asked Kraft's team to focus on innovative approaches to significantly decrease total operational costs while maintaining safety and reliability.

Recommendations from the report will be consolidated with NASA's ongoing Office of Space Flight Review and forwarded to Administrator Goldin in mid-May. Bryan O'Connor, Deputy Associate Administrator for Space Shuttle, said, "The Kraft report's themes of reducing the role of civil service employees, increasing contractor accountability, and reducing the number of government-to-contractor interfaces are all consistent with Administrator Goldin's guidelines for restructuring the Shuttle program."

O'Connor said some of the recommendations from the Kraft report already are being implemented. "For example, we agree with Dr. Kraft's team that a review of program requirements is appropriate after more than a decade of experience operating this system," he said. "Our goal is to significantly reduce the number of normal maintenance and launch processing steps required before each flight, based on that wealth of experience."

-more-

The Kraft report also recommended minimizing modifications to the Shuttle fleet. Changes in hardware and software should only be made "to improve safety, reduce operating costs, make the vehicle more reusable, or test new technologies," the report concluded.

O'Connor said, "We are minimizing changes to the fleet consistent with the priorities laid out by the Kraft committee. We agree with this recommendation."

The Kraft team's report also recommended the Space Shuttle program should:

- Establish a clear set of program goals, placing a greater emphasis on cost-efficient operations and user-friendly payload integration.

- Redefine the management structure, separating development and operations and reduce NASA's role in the daily operation of the Space Shuttle.

- Provide the necessary environment and conditions within the program to pursue these goals.

"The Shuttle is a very mature space vehicle, with over 65 successful launches," Kraft said. "The team felt the Shuttle program is being managed about as well as it can be, given the present management structure. We commend them on what they've accomplished to date, about a 25 percent reduction in their operations costs over the past three years.

"But if NASA wants to make more substantive gains in terms of efficiency, cost savings and better service to its customers, we think it's imperative they act on these recommendations and make a commitment to this proposed management structure," Kraft said. "And we believe these savings are real, achievable, and can be accomplished with no impact to the safe and successful operation of the Shuttle system."

The report stated, "Given the maturity of the vehicle, a change to a new mode of management with considerably less NASA oversight is possible at this time."

Of the management options the team considered, the structure preferred was to consolidate operations under a single business entity, such as a prime contractor. This option increases the contractors' role and responsibility in the Shuttle program, allows the contractor to focus on Shuttle operations and provides for a more direct introduction of profit motives and cost reduction.

The team also concluded the prime contractor option would be the most achievable and practical. By selecting from among the current contractors, as opposed to an open competition, the team said NASA "could accomplish all the objectives in a less disruptive and more expeditious manner, realizing potential cost reductions more quickly."

The team recommended seven steps to ensure the success of the new management structure:

- Freeze the current vehicle configuration and minimize future modifications. Modifications which are made should concentrate on improving safety and reducing operating costs.

- Conduct a comprehensive requirements review with the goal of significantly reducing procedures between flights based upon experience gained during almost 70 flights to date.

- Consolidate and reduce program and project elements, limiting NASA invovlement in operations and minimizing NASA-contractor interfaces.

- Restructure and reduce the overall Safety Reliability and Quality Assurance (SR&QA) elements -- without reducing safety.

- Streamline payload processing and integration, minimizing costs and reducing the length of time required to place a payload aboard the Space Shuttle.

- Structure operational contracts to provide real incentive to reduce costs while accomplishing safe and successful missions.

- Allow the hiring of NASA personnel by the prime and subcontractors to ensure proper expertise and talents exist to continue with safe and successful operations.

The Shuttle Management Review Team consisted of aerospace executives, business leaders, and former NASA officials. They were:

- Dr. Christopher C. Kraft Jr., Team Chairman
  Former Director, Johnson Space Center

- Col. Frank Borman, USAF (Ret.)
  Former Eastern Airlines Chief Executive Officer and retired astronaut

- George Jeffs
  Former President, Rockwell International North American Aerospace Operations

- Robert Lindstrom
  Former Senior Vice President and General Manager for Space Operations, Thiokol Corporation, and retired manager of the Space Shuttle Projects Office, Marshall Space Flight Center, Huntsville, AL

- Thomas Maultsby
  Vice President, General Research Corporation, and former senior Department of Defense representative to NASA Headquarters, Washington, DC

- Isom Rigell
  Former Vice President, Florida Operations, United Space Boosters, Inc., and retired Director, Shuttle Payloads and former Director, Launch Vehicle Operations, Kennedy Space Center, FL

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

March 16, 1995

Douglas Isbell
Headquarters, Washington, DC
(Phone: 202/358-1753)

Jim Doyle
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE: 95-28

NEW MAGELLAN GLOBAL VIEWS OF VENUS RELEASED

Newly processed global views of Venus showing its rich and varied landscape have been released by scientists associated with NASA's Magellan mission, which concluded last October after mapping more than 98 percent of the planet with imaging radar.

"These images will form the basis for all future scientific studies of Earth's sister planet, and will provide the necessary maps for all future Venus missions," said Magellan Project Scientist Dr. R. Stephen Saunders of NASA's Jet Propulsion Laboratory, Pasadena, CA.

The images -- mosaics collected from data gathered during Magellan's orbital mission -- were released at the Lunar and Planetary Science Conference in Houston, TX, where a number of scientists gave presentations based on the new imagery database.

The Magellan spacecraft was commanded to plunge into the atmosphere of Venus last Oct. 12 after performing a final aerodynamic experiment. Mission activities officially ended in mid-February of this year, but some science tasks will continue through fiscal year 1996.

Magellan was launched May 4, 1989, and entered orbit around Venus in August 1990. In addition to its successful radar mapping activities, the spacecraft also acquired a high-resolution gravity field map of 95 percent of the planet.

Scientists at the conference presented papers on the geology, atmosphere, climate, volcanoes and tectonic processes of Venus, based on the vast Magellan data set.

-more-

Full-resolution copies of the new Magellan images are available on CD-ROM from the National Space Science Data Center in Greenbelt, MD (301/286-6695). Electronic image files of the new images are available from JPL's public access computer site, via Internet and the World Wide Web at the address http://www.jpl.nasa.gov, or by anonymous file transfer protocol (ftp) at the address ftp.jpl.nasa.gov, or by dial-up modem to the telephone number 818/354-1333.

JPL managed the Magellan mission for NASA's Office of Space Science, Washington, DC.

- end -

EDITORS NOTE: Photos are available to the news media by faxing your request to the NASA Headquarters Broadcast and Imaging Branch at 202/358-4333. Color photo numbers are 95-HC-111 and 95-HC-112; black-and-white photo numbers are 95-H-114 and 95-H-115.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Brian Dunbar
Headquarters, Washington, DC
(Phone: 202/358-1547)

March 20, 1995

Jan Ruff
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-6255)

RELEASE: 95-29

GODDARD SPACE FLIGHT CENTER'S DIRECTOR TO LEAVE NASA

Dr. John M. Klineberg, Director of NASA's Goddard Space Flight Center (GSFC), Greenbelt, MD, has announced he will retire after nearly 25 years with the Agency.

Dr. Klineberg has not set a specific date for his retirement. He intends to explore opportunities in private industry or a university, but he has no specific plans.

"This is one of the most exciting jobs in the world. But the time is right for me to try something different," Klineberg said. "I look forward to new challenges, and take with me fond memories of my NASA experience."

As GSFC director, Klineberg has been responsible for planning, organizing and directing the day-to-day activities required to accomplish the missions assigned to one of NASA's most diversified centers. GSFC is engaged in extending the horizons of human knowledge not only about our Earth and its environment, but also the solar system and the universe.

"I want to congratulate and thank John for his outstanding leadership and service to NASA," said NASA Administrator Daniel S. Goldin. "He has shown exceptional leadership in heading several of NASA's most important programs, including Mission to Planet Earth and the Hubble Space Telescope. Goddard and all of NASA have benefited from his remarkable vision and leadership."

"Not only has John overseen the launch of the next generation of U.S. weather satellites, but his center is leading the way in environmental research," said Dr. Charles Kennel, Associate Administrator for Mission to Planet Earth. "Under Klineberg, Goddard has been helping to create an interdisciplinary

-more-

approach to studying our environment that will bear fruit into the next century. The Mission to Planet Earth community has nothing but affection and respect for John, and we wish him well."

"NASA's greatest accomplishment in recent years? The successful Hubble Space Telescope servicing mission is due in large part to the vision of Dr. Klineberg, whose center manages the project," said Dr. Wesley T. Huntress, Jr., NASA's Associate Administrator for Space Science. "This high-stakes mission was critical to the future of the agency, and it was a stunning success. As we have seen during the past year, Hubble is revolutionizing space science as a result of what was accomplished during the servicing mission."

Klineberg came to GSFC as Center Director in July 1990, from the Lewis Research Center in Cleveland, Ohio, where he had served as Director (May 1987 - July 1990) and as Deputy Director (July 1979 - May 1987).

Klineberg went to Lewis from NASA Headquarters, Washington, DC, where he had been Deputy Associate Administrator for the Office of Aeronautics and Space Technology. His NASA career includes positions at the Ames Research Center, Mountain View, CA, where he did research in transonic flows, and at NASA Headquarters as head of the Low-Speed Aircraft Branch.

Before joining NASA, Klineberg worked on aircraft aerodynamics at the Grumman Aircraft Company, Inc., Bethpage, NY, in 1959 and at the Douglas Aircraft Company, Inc., Santa Monica, CA, 1960-1962, on lifting re-entry vehicles and ballistic missiles. He performed fundamental research on fluid interactions at supersonic speeds at California Institute of Technology, Pasadena, CA, as part of his thesis work and while employed as a research engineer.

Klineberg's accomplishments have earned him many prestigious awards, including NASA's Distinguished Service Medal and Outstanding Leadership Medal, and the U.S. Government's rank of Distinguished and Meritorious Executive. He was a member of the Flight Mechanics Panel of NATO's Advisory Group for Aerospace Research and Development, a participant in Purdue University's Old Masters Program and Leadership Cleveland. He is a member of Sigma Xi and a Fellow of the American Institute of Aeronautics and Astronautics (AIAA).

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Douglas Isbell
Headquarters, Washington, DC
(Phone: 202/358-1753)

March 20, 1995

Diane Ainsworth
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE: 95-30

LOCKHEED MARTIN ASTRONAUTICS TO BUILD MARS '98 SPACECRAFT

Two small spacecraft -- an orbiter and a lander -- to be launched to Mars in 1998 to help scientists trace the evolution of the planet's climate and search for water in the Martian soil will be built for NASA by Lockheed Martin Astronautics of Denver, CO.

Dr. Edward C. Stone, Director of NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA, announced the selection today after a fast-paced, industry-wide competition lasting only two months. The estimated value of the contract is $92.2 million.

"Lockheed Martin Astronautics presented a very compelling case for its selection, in light of NASA's rigorous demands for two very complicated planetary missions in 1998," Stone said. "These requirements -- to develop and operate two spacecraft at the same level of funding that was previously allocated for a single mission -- brought in excellent designs for the orbiter and lander spacecraft from Lockheed Martin. This will result in significant savings because they will both be developed under the same roof."

The pair of spacecraft, currently called the Mars Surveyor 1998 orbiter and lander, continues NASA's efforts to cut costs by building smaller, less expensive planetary spacecraft. The 1998 orbiter will be just one-half the weight of Mars Global Surveyor, an orbiter that will be launched in 1996. The 1998 lander, similarly, will be just half the weight of the 1996 Mars Pathfinder, the smallest planetary lander yet constructed.

The new missions will be the second set of spacecraft in NASA's decade-long program of Mars exploration, known as the Mars Surveyor Program. The spacecraft will be launched from Cape Canaveral, FL, during the Mars launch opportunity which falls between December 1998 and February 1999.

-more-

"The pair of spacecraft will be designed to continue exploring the history of climate change on Mars and initiate a search for water in the Martian soil," said Project Manager Dr. John McNamee. "Lockheed Martin Astronautics has demonstrated its commitment to our goals of continued exploration and forming a teaming relationship with industry by its willingness to invest internal funds to reduce some of the costs associated with building spacecraft for Mars Surveyor and other programs.

"In addition, Lockheed Martin demonstrated a commitment to mission success," he added, "by its willingness to forego all potential award fees in the event either spacecraft fails to perform its mission at Mars."

Science instruments for the 1998 lander will be selected following an announcement of opportunity planned for release by NASA in May. The 1998 orbiter will carry a camera (also to be selected through the May announcement of opportunity) and one of the two remaining science instruments from the former Mars Observer mission that could not be carried on the 1996 Mars Global Surveyor mission.

The new pair of spacecraft will return information that builds upon the goals of the 1996 missions, which seek to answer key questions about Mars' early history. The 1998 missions, however, will take that scientific quest a step further, initiating a search for water in the Martian soil and delving into longstanding theories about whether primitive life ever existed early in the planet's history.

During and after its primary science mission, the 1998 Mars Surveyor orbiter also will serve as a data relay satellite for the companion lander and for future NASA and international lander missions to Mars.

The extremely light weights of the new lander and orbiter will allow them to be launched on a newly designed launch vehicle, called the Med-Lite, which is roughly half the size of the Delta II launch vehicles being used for the 1996 Mars Global Surveyor and Mars Pathfinder missions. A Med-Lite will be capable of delivering about 1,000 pounds (450 kilograms) of hardware to Mars.

JPL manages the Mars Surveyor Program for NASA's Office of Space Science, Washington, DC.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Dwayne C. Brown
Headquarters, Washington, DC
(Phone: 202/358-1600)

March 21, 1995

NOTE TO EDITORS: N95-17

AEROSPACE SAFETY ADVISORY PANEL TO PRESENT REPORT TO NASA

The Aerospace Safety Advisory Panel (ASAP) will present its annual report to NASA Administrator Daniel S. Goldin at 2:00 p.m. EST on Thurs., March 23, 1995, in the Administrator's Program Review Center (9H40), NASA Headquarters, 300 E Street S.W., Washington, DC.

Each year, the panel reviews and evaluates current and future NASA programs and activities and reports their findings to the NASA Administrator. Priority is given to programs that involve the safety of human flight.

Following the Apollo spacecraft fire on January 27, 1967, Congress enacted legislation to establish the ASAP as a senior advisory committee to NASA.

The ASAP report will be available for media representatives at 1:00 p.m. Thursday in the NASA Headquarters Newsroom (202/358-1600). The report also will be distributed at the meeting.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

March 21, 1995

Tammy Jones
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-5566)

Ray Villard
Space Telescope Science Institute, Baltimore, MD
(Phone: 410/338-4514)

RELEASE: 95-31

HUBBLE MONITORS WEATHER ON NEIGHBORING PLANETS

"The weather on Mars: another cool and clear day. Low morning haze will give way to a mostly sunny afternoon with high clouds. The forecast for Venus: hot, overcast, sulfuric acid showers will continue. Air quality is slightly improved as smog levels subside."

That kind of weathercast is now possible as NASA's Hubble Space Telescope serves as an interplanetary weather satellite for studying the climate on Earth's neighboring worlds, Mars and Venus.

To the surprise of researchers, Hubble is showing that the Martian climate has changed considerably since the unmanned Viking spacecraft visited Mars in the mid-1970s, which was the last time astronomers got a close-up look at weather on the Red Planet for more than just a few months. Hubble images of clouds and spectroscopic detection of an ozone abundance in Mars' atmosphere, all indicate that the planet is cooler, clearer and drier than a couple of decades ago.

In striking contrast, Hubble's spectroscopic observations of Venus show that the atmosphere continues to recover from an intense shower of sulfuric "acid rain" triggered by the suspected eruption of a volcano in the late 1970s. This is similar to what happens on Earth when sulfur dioxide emissions from coal power plants are broken apart in the atmosphere to make acid rain. On Venus, this effect takes place on a planetary scale.

- more -

Although the close-up visits by numerous unmanned spacecraft provided brief glimpses of weather on these planets, the long-term coverage offered by Hubble has never before been possible. Knowledge about the weather is critical to planning future missions to these worlds. In the case of Mars, being able to predict the weather will be critical prior to human exploration of the planet.

Studying conditions on Mars and Venus might also lead to a better understanding of Earth's weather system. Apparently, processes that occurred early in the solar system's history sent terrestrial planets along very different evolutionary paths. The neighboring planets are grand natural laboratories for testing computer models that will lead to a general theory of the behavior of planetary atmospheres.

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc. (AURA) for NASA, under contract with the Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).

- end -

EDITOR'S NOTE: A Science Background Fact Sheet to accompany this release is available via fax by calling 202/358-1600.

Images and video are available to news media representatives by calling the Broadcast and Imaging Branch at 202/358-1900. Photo numbers are:

	Color	B & W
Venus	HC-95-114	95-H-117
Mars, single face	HC-95- 115	95-H-118
Mars, three faces	HC-95- 113	95-H-116

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Ray Castillo
Headquarters, Washington, DC
(Phone: 202/358-4555)

March 21, 1995

June Malone
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/544-7061)

RELEASE: 95-32

NEW SPACE SHUTTLE MAIN ENGINE READY FOR FLIGHT

NASA has successfully completed testing a new high pressure liquid oxidizer turbopump and is ready to fly an upgraded main engine on its first Space Shuttle flight in June 1995.

"Completing flight certification of the Alternate High Pressure Oxidizer Turbopump is a major milestone in the Space Shuttle Main Engine (SSME) program," said Otto Goetz, SSME deputy project manager for development, Marshall Space Flight Center, Huntsville, AL.

"The Alternate Turbopump is now ready for its first flight and for nine flights thereafter. Credit goes to Pratt and Whitney and Rocketdyne, to the experts in Marshall's Science and Engineering Directorate, and to the folks at Stennis Space Center who supported an aggressive test program," Goetz added.

NASA completed final certification of the new liquid oxygen high pressure turbopump on March 15. The new pumps underwent a test program that is equivalent to 40 Space Shuttle flights. By achieving this milestone, NASA reached the final step in certifying the turbopumps for flight.

"The certification is unprecedented in that none of the certification units had to be removed from the engine during the test series," said Goetz. NASA did not perform any detailed inspections other than verifying free pump rotation after each test.

The high pressure liquid oxygen pumps used in the current SSME must be removed after each flight for inspection. The new pumps will not need any detailed inspection until they have flown ten times. The new pumps also are expected to increase safety margins and reliability for the SSMEs. These engines provide approximately 1.5 million pounds of thrust during launch of the Shuttle into low-Earth orbit.

-more-

The new turbopump also incorporates state of the art technology in its design. The pump housing is produced through a casting process, thereby eliminating all but six of the 300 welds that exist in the current pump. Eliminating welds is one of the keys to increasing safety margins on the main engine.

The new pump uses a new ball bearing material -- silicon nitride (a type of ceramic). Silicon nitride offers several advantages over the steel bearings currently in use. The material is 30 percent harder than steel and has an ultra-smooth finish which allows for less friction during pump operation. Friction creates heat that leads to wear on the bearings. These new ceramic bearings eliminate concerns over excessive wear to the pump-end ball bearing.

Along with the new turbopump, NASA will fly a new two-duct powerhead. This new powerhead will significantly improve fluid flows within the engine system by decreasing pressure, reducing maintenance and enhancing overall performance of the engine. It will replace three smaller fuel ducts in the current design with two enlarged ducts to achieve improved engine performance. This new engine configuration is being called the Block I engine.

On STS-70, one SSME will be a new Block I engine. The remaining two engines will have the current SSME design. The first flight planned to incorporate the new pumps into all three engines is STS-73, currently targeted for launch in September 1995.

The SSME project is managed by NASA's Marshall Space Flight Center. Pratt and Whitney, West Palm Beach, FL, developed and manufactured the new pump; Rocketdyne, Canoga Park, CA,will integrate the pump into the main engine.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1727)

March 21, 1995

Jim Sahli
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-8955)

RELEASE: 95-33

NASA'S RESTRUCTURED FUSE PROGRAM COSTS LESS, FLIES EARLIER

NASA has accepted a proposal from Johns Hopkins University, Baltimore, for restructuring the agency's Far Ultraviolet Spectroscopic Explorer (FUSE) mission from $254 million to $100 million in addition to launching the spacecraft two years earlier than originally planned.

The change is part of an overall restructuring of the Explorer program directed by Dr. Wesley T. Huntress, Jr., NASA's Associate Administrator for Space Science, Washington, DC. The FUSE mission changes from a Delta-class into a smaller class mission with launch scheduled for November 1998.

"The FUSE principal investigator Dr. Moos and his team are to be congratulated for their accomplishment," said Huntress. "This very difficult effort, which the team succeeded in doing in a very short period of time, involved bringing down the size, complexity and cost of the mission while preserving its essential ultraviolet science.

"Although the process was full of difficult and painful choices and increased the level of risk to the mission, the space physics and astrophysics communities ultimately will benefit because we will be able to start the new Medium Explorer (MIDEX) program and give them more frequent flight opportunities," Huntress said.

The goal of the Explorer program restructuring was to enable funding for more frequent MIDEX missions to be launched on a new medium-lite expendable launch vehicle, with development cost not to exceed $70 million (not including launch, mission operations and data analysis).

"Under this restructuring, Dr. Moos will be accountable to NASA for mission success, taking full responsibility for all aspects of the mission including instrument and spacecraft definition, development, integration and testing," said David Mengers, FUSE Mission Manager at the Goddard Space Flight Center, Greenbelt, MD.

- more -

"Also included are the ground system, science operations, mission operations and data analysis. The principal investigator has maximum flexibility to conduct their investigations," said Mengers.

The FUSE mission was designed to study the origin and evolution of the lightest elements -- hydrogen and deuterium -- created shortly after the Big Bang, and the forces and processes involved in the evolution of galaxies, stars and planetary systems. The far ultraviolet region of the spectrum can only be observed outside the Earth's atmosphere.

Still under Phase B definition studies, formal NASA acceptance of the program for development occurs this Fall following reviews and acceptance by NASA and the project's international partners, Canada and France.

The Explorer program is managed by the Explorer Project Office at the Goddard Space Flight Center for the Office of Space Science, Washington, DC.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Douglas Isbell
Headquarters, Washington, DC
(Phone: 202/358-1753)

March 22, 1995

Peter Waller
Ames Research Center, Mountain View, CA
(Phone: 415/604-3938)

RELEASE: 95-34

TESTS SHOW GALILEO PROBE SET FOR FLIGHT TO JUPITER

Key operational tests of the atmospheric probe on NASA's Jupiter-bound Galileo spacecraft have been successfully completed, demonstrating that the probe is in good health and ready for the first-ever descent into the atmosphere of an outer planet this December.

The just-completed testing followed NASA's first interrogation of the atmospheric probe in 27 months, and "it went perfectly," said Marcie Smith, Galileo probe project manager at NASA's Ames Research Center, Mountain View, CA. The probe now stands ready to separate from the Galileo orbiter spacecraft in July and then fly the remaining 50 million miles of its flight to Jupiter on a solo trajectory.

"We wanted to be sure the power system was in good shape, and it was," Smith said, "and so were the other probe systems."

"The recent probe tests showed that each of its three lithium battery modules were operating normally," said Charles Sobeck, probe engineering manager. Both accelerometers of the atmosphere structure experiment were normal. The sampling chamber of the Neutral Mass Spectrometer, which will analyze the composition of Jupiter's atmosphere, was pumped out in preparation for descent.

"Engineers also conducted an end-to-end test of the probe data compression system, and it worked very well," Sobeck said. Command systems for the two redundant data systems worked without a flaw, as did the data return link for the primary system.

- more -

Further data on the operation of the probe radio receiver aboard the orbiter will be returned and analyzed in coming weeks.

Upon its arrival at Jupiter on December 7, 1995, the probe will make the first entry into the atmosphere of one of the solar system's giant gas planets. This will be the most difficult planetary entry ever attempted, with the probe expected to reach a speed of 106,000 mph before it encounters deceleration forces of up to 350 G's (350 times Earth gravity) through friction with Jupiter's atmosphere.

After entry, the probe will descend about 400 miles into the planet's complex atmosphere, making the first direct measurements of its clouds, lightning, winds and other features.

Jupiter is the largest planet in the solar system, with about 300 times the mass of the Earth. The planet has its own internal heat source, and its spectacular banded appearance and many other active cloud features such as the Great Red Spot make its atmosphere a topic of great scientific interest.

NASA engineers last communicated with the probe in November and December 1992. At that time, it was in "excellent shape," Smith said. While the vacuum of space is considered a safe environment for non-operating spacecraft, "it will be six years after the batteries were built before they get used to power the probe," she explained, "so we wanted to check them one more time before release."

After deploying the probe, the Galileo orbiter will change its course to pass 133,000 miles above Jupiter's clouds, while the probe continues on and descends into the atmosphere. The probe will radio its data to the orbiter, which will store it for later transmission to Earth before beginning two years of orbital-based observations of Jupiter, its moons and its powerful magnetosphere.

"We are delighted that the probe checkout went so well," said Galileo Project Manager William J. O'Neil of NASA's Jet Propulsion Laboratory, Pasadena, CA. The successful probe checkout was the first activity to be carried out under new Galileo flight software that was transmitted to the spacecraft in January and February, indicating that all of the major elements of the mission are ready for the start of its encounter with Jupiter.

The Galileo probe project is managed by NASA Ames. The overall Galileo mission is managed by NASA's Jet Propulsion Laboratory. The probe was built by Hughes Aircraft Co., El Segundo, CA.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

March 23, 1995

Brian Dunbar
Headquarters, Washington, DC
(Phone: 202/358-1547)

Keith Koehler
Wallops Flight Facility, Wallops Island, VA
(Phone: 804/824-1579)

RELEASE: C95-e

NASA SELECTS CSC TO NEGOTIATE $67.7 MILLION CONTRACT

NASA's Wallops Flight Facility, Wallops Island, VA, has selected Computer Sciences Corp.'s Applied Technology Division, Falls Church, VA, to negotiate a $67.7 million cost-plus-award-fee contract for engineering support and related services at Wallops.

The contract, expected to be effective July 1, 1995, will consist of a one-year basic period, two one-year hard options and one two-year hard option.

The contract will provide initial staffing of approximately 251 personnel to support Wallops in instrumentation and mechanical systems, sounding rockets and balloons, safety analysis, meteorology, resources management, metal trades and instrumentation construction support.

The contract also will provide project management, vehicle assembly and launch, automatic data processing, applied science, facilities engineering, plant operations and maintenance, environmental programs, institutional and program safety, technical illustrating and editing.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Beth Schmid
Headquarters, Washington, DC
(Phone: 202/358-1760)

March 24, 1995

Ernie Shannon
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-6256)

RELEASE: 95-35

NOAA-14 INVESTIGATIVE BOARD FORMED TO STUDY ANOMALY

An investigative board has been formed at the Goddard Space Flight Center, Greenbelt, MD, to study a problem that developed earlier this month with the NOAA-14 microwave sounding unit, which measures the vertical temperature of the atmosphere up to about 12 miles (20 kilometers).

On March 2, the unit suddenly stopped performing its normal scan sequence. Its motor continued to draw current causing some overheating, but engineers discovered the problem and shut down the motor before any apparent damage occurred. On March 10, the investigative board was formed with Goddard's Jim Ryan, head of the Mechanical Engineering Branch in the Engineering Directorate, chairing the board.

As part of the board's initial investigation, the microwave sounding unit was reactivated for short periods on March 15 and 17 to determine if the unit would work. These reactivations were successful and the unit was able to perform the scanning sequence for an eight-minute period, but then was shut down to allow time to further study and understand why the mechanism initially stalled.

Presently, the investigative board has decided to keep the instrument off until a software patch is implemented that would command the unit's motor to shut down should the scanning sequence suddenly stop again.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

March 26, 1995

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

VIDEO ADVISORY: V95-31

SHUTTLE ATLANTIS ADAPTED FOR MIR DOCKING MISSION

Installation of the docking adapter into the payload bay of the Space Shuttle Atlantis will be featured as the opening segment on Monday's NASA TV video news file. The adapter will serve as a connecting bridge between Atlantis and the Russian Mir space station during the STS-71 mission, scheduled for late June. Footage of the STS-71 crew members checking out the docking equipment will be aired, followed by footage of the Spacelab which will serve as an on-orbit medical research laboratory during the mission. NASA TV will end Monday's news feed with a replay of American astronaut Norm Thagard narrating a tour of the Mir space station. Thagard, who is the first American to join a Mir crew as part of growing American-Russian space cooperation, will take NASA TV viewers through the Russian space station and give his insights into life aboard the spacecraft.

Video News File (transmission times: 12 p.m., 3 p.m., 6 p.m. and 9 p.m. EST)

ITEM #1: *Docking adapter installed in Atlantis*	TRT:	5:00
ITEM #2: *Atlantis crew members check docking device*	TRT:	4:28
ITEM #3: *Spacelab -Mir Installation*	TRT:	7:55
ITEM #4: *Tour of the Mir space station by American astronaut Norm Thagard*	TRT:	8:47

All TRT's are approximate and subject to change.

Public Affairs Contacts

Space Shuttle Atlantis preparations	Lisa Malone, 407/867-2468
U.S.-Russian Space Cooperation	Debra Rahn, 202/358-1639

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Michael Braukus
Headquarters, Washington, DC
(Phone: 202/358-1979)

March 28, 1995

Ann Hutchison
Ames Research Center, Mountain View, CA
(Phone: 415/604-4968)

RELEASE: 95-37

NASA TESTS PAINLESS WAYS OF MEASURING INTRACRANIAL PRESSURE

NASA scientists are testing two diagnostic devices to measure pressure inside the head, or intracranial pressure (ICP), without penetrating the skull or skin.

Scientists at NASA's Ames Research Center, Mountain View, CA, hope the technology will help them determine whether increased ICP contributes to the headaches, nasal congestion and space motion sickness that some astronauts experience during space flight. There currently is no direct evidence that the space environment increases ICP because there is no way to accurately and non-invasively measure changes in ICP in humans.

Improved means of measuring intracranial pressure may benefit victims of trauma to the head, as well as astronauts. "Early non-invasive measurements of ICP may help reduce both the mortality and morbidity associated with head trauma," said Alan R. Hargens, Ph.D., of Ames Life Sciences Division. A severe blow to the head, as may result from a car or motorcycle accident, may cause swelling of the brain and increased intracranial pressure.

Hargens said NASA and the National Institutes of Health recently identified non-invasive ICP measurements as a critical parameter in investigating problems of astronauts in space and in head trauma patients on Earth. Current clinical techniques for measuring pressure in the head require invasive surgical procedures to implant a pressure sensor.

Hargens is leading Ames' effort to provide a clinical evaluation of the two devices' ability to measure changes in ICP in humans. One device, developed by Dr. John Cantrell and Dr. Tom Yost at NASA's Langley Research Center, Hampton, VA, measures distances across the skull. This system is based on the assumption that increased pressure will cause slight distention, or swelling of

-more-

the skull. An ultrasound wave is transmitted through the front of the skull by a small disk secured to the forehead. The wave passes through the brain tissue, reflects off the opposite side of the skull, and is received by a sensor in the disk.

The second technique uses a very light mechanical stimulus applied to the forehead. "It's equivalent to dropping an eraser from a standard pencil onto the forehead from a height of 6 inches (15 centimeters)," Hargens said. The stimulus is transferred through the skull and is received by sensors placed strategically on the scalp. Changes in pressure inside the head can then be measured by examining changes in the response signal. Scientific Atlanta Inc., of Atlanta, GA, and CytoProbe Corp. of San Diego, developed and patented this system, which they provided to Ames for testing.

"If this research is successful, we will be able to validate non-invasive techniques for measuring intracranial pressure," Hargens said. "This could lead to their use as diagnostic tools both for clinical applications on Earth and for astronauts during space flight. We hope this will lead to commercial development of the devices and eventually to future space flight experiments."

- end -

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

For Release

March 29, 1995

VIDEO ADVISORY: V95-33

X-34 MODEL ROLL OUT FEATURED ON NASA TV MARCH 30

NASA TV will open Thursday's news video feed by showing the unveiling of a model of the X-34, a small reusable launch vehicle being developed by Orbital Sciences Corporation and Rockwell International for NASA. The X-34 is a launch vehicle that will help provide access to space faster, better, and cheaper. The unveiling ceremony will take place at Washington's Dulles International Airport Thursday morning at 9 a.m. EST. Following the X-34 unveiling, NASA TV will replay video of researchers using ultrasound technology to measure pressure on the human brain without penetrating the skull. The intracranial pressure tests are being conducted by scientists at NASA Ames Research Center, Mountain View, CA, to help determine whether increased pressure on the brain contributes to headaches, nasal congestion and space motion sickness. Footage of preparations for the Space Shuttle Atlantis' June mission will close out the Thursday feed.

NOTE: The next television event from the Mir space station will be a replay of a CNN Friday morning interview with astronaut Norm Thagard. The interview will be aired as Friday's video news file opening feature.

Video News File (transmission times: 12 p.m., 3 p.m., 6 p.m. and 9 p.m. EST)

ITEM #1:	*X-34 Roll-out at Dulles Airport*	TRT:	TBD
ITEM #2:	*Intracranial pressure test*	TRT:	2:30
ITEM #3:	*Intracranial Mechanical Stimulus*	TRT:	1:06
ITEM #4:	*Interview with Richard Ballard*	TRT:	2:38
ITEM #5:	*Docking adapter installed in Atlantis*	TRT:	5:00
ITEM #6:	*Atlantis crew members check docking device*	TRT:	4:28
ITEM #7:	*Spacelab -Mir Installation*	TRT:	7:55

All TRT's are approximate and subject to change.

Public Affairs Contacts

X-33 program	Jim Cast, 202/358-1779
Intracranial pressure testing	Ann Hutchison, 415/604-9000
Space Shuttle Atlantis preparations	Lisa Malone, 407/867-2468

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

Dom Amatore
Marshall Space Flight Center, AL
(Phone: 205/544-6533)

For Release

March 29, 1995

Release: 95-38

X-33 COOPERATIVE AGREEMENTS SIGNED

NASA continues on a fast track with its Reusable Launch Vehicle technology program with the signing of three cooperative agreements to design the next generation space booster known as the "X-33."

"The procurement process on the X-33 exemplifies the new way of doing business at NASA," said Administrator Daniel S. Goldin. "The announcement of the competition and the selection of the winners took a matter of weeks, not years. The structure of the agreements puts the focus squarely on a true public/private partnership, and on outstanding industry performance. This is a critical step in positioning the United States as a competitive player in the commercial space marketplace of the future," Goldin said

The X-33 Cooperative Agreements were signed with Lockheed Advanced Development Co., Palmdale, CA; McDonnell Douglas Aerospace, Huntington Beach, CA; and Rockwell International Corporation, Space Systems Division, Downey, CA. Over the next 15 months, known as "Phase I," the Agency will work with these companies on concept definition and design of the X-33, a vehicle intended to demonstrate the technology required for a 21st-Century commercial reusable space launch system.

NASA will provide approximately $7 million to each of the three participants during this design phase, with each expected to invest a matching sum in the venture.

The goal of the Reusable Launch Vehicle technology program is to enable significant reductions in the cost of access to space, and to promote the creation and delivery of new space services and other activities that will improve U.S. economic competitiveness. The program will implement the

-more-

National Space Transportation Policy, issued by the White House in 1994, and will accelerate the development of new launch technologies and concepts to contribute to the continuing commercialization of the national space launch industry.

During the 15-month design phase, each firm will develop its total X-33 business investment strategies, operations planning and vehicle design and analysis. If the government then decides to proceed to the next phase -- construction and flight demonstration the X-33 -- NASA would competitively select one or more of the firms as its industry partner(s) in that effort. The program could continue through the end of the decade and could lead to a decision by government and industry to develop an operational reusable launch system. As part of each design team, government laboratories will participate with industry members to apply the technology developed in the labs toward this next-generation launch system.

NASA's Office of Space Access and Technology, Washington, DC, manages the Reusable Launch Vehicle technology program. The Marshall Space Flight Center, Huntsville, AL, is the host center for the X-33 program.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to (202) 358-4043.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

March 30, 1995

Mark Hess/Ray Castillo
Headquarters, Washington, DC
(Phone: 202/358-1778)

Kyle Herring
Johnson Space Center, Houston
(Phone: 713/483-5111)

RELEASE: 95-39

LUCID PRIME FOR SECOND MIR STAY; LINENGER SELECTED FOR THIRD

Astronaut Shannon W. Lucid, Ph.D., will be the second American to be a prime crew member during a five-month stay aboard Russia's space station Mir in 1996. Jerry M. Linenger (Commander, Medical Corps, USN) will be the third American to fly to the orbital laboratory, also in 1996.

John E. Blaha (Colonel, USAF, Ret.) will serve as backup to Lucid and Scott E. Parazynski will act as backup to Linenger. Lucid and Blaha have been training since February in Star City, Russia. Linenger and Parazynski will begin training at the Gagarin Cosmonaut Training Center in late May. Blaha and Parazynski will continue training at Star City for stays aboard Mir on future missions.

These assignments continue the U.S./Russia human space flight cooperation, which consists of a three-phased program.

Phase one includes seven planned Space Shuttle-Mir missions between 1995 and 1997, including rendezvous, docking and crew transfers. The Space Shuttle will assist with crew exchange, resupply and payload activities for Mir. Russian cosmonauts have flown on two Shuttle Missions -- STS-60 in 1994 and STS-63 last month. Four or more U.S. astronaut stays aboard Mir are planned, totaling nearly two years of on-orbit time.

Phase two is the joint development of the core international Space Station. Phase three is the expansion of the Space Station to include all of the international partners.

-more-

Lucid, 52, has flown four times aboard the Shuttle. She was a mission specialist on STS-51-G in June 1985, STS-34 in October 1989, STS-43 in August 1991 and STS-58 in October 1993. She received her master of science and doctorate of philosophy degrees in biochemistry from the University of Oklahoma in 1970 and 1973, respectively.

Blaha, 52, has flown on four Shuttle missions, STS-29 in March 1989, STS-33 in November 1989, STS-43 in August 1991 and STS-58 in October 1993. He received a master of science degree in astronautical engineering from Purdue University in 1966.

Linenger, 40, flew on Discovery's STS-64 mission in September 1994. He earned a doctorate in medicine from Wayne State University in 1981 and a master of public health degree in health policy and a doctor of philosophy degree in epidemiology from the University of North Carolina in 1989.

Parazynski, 33, was a member of Atlantis' STS-66 crew in November 1994. He completed medical school at Stanford University in 1989 and served his medical internship at the Brigham and Women's Hospital of Harvard Medical School in 1990.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

March 30, 1995

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

Dom Amatore
Marshall Space Flight Center, AL
(Phone: 205/544-6533)

RELEASE: 95-40

COOPERATIVE AGREEMENT SIGNED FOR X-34

NASA and Orbital Sciences Corp., Dulles, VA, have signed a cooperative agreement to jointly develop a small, reusable space booster -- the "X-34" -- which will serve as a test bed to demonstrate reusable launch vehicle technology.

The X-34, with potential of becoming a commercial booster, is expected to significantly reduce mission costs for 1,000 to 2,000-pound payloads into low-Earth orbit. Flight tests for the X-34 are planned for late 1997, with launch expected by mid-1998. At that time, technology test bed applications will feed directly into plans for developing a larger, next-generation reusable launch vehicle, the X-33. Cooperative agreements for the X-33 were signed earlier this week.

NASA plans to provide $70 million to Orbital Sciences Corp. through Fiscal Year 1999 for X-34 development. Orbital Sciences Corp. will invest at least an equal amount of its funds in the joint endeavor.

The goal of the Reusable Launch Vehicle technology program is to enable significant reductions in the cost of access to space, and to promote the creation and delivery of new space services and other activities that will improve U.S. economic competitiveness. The program will implement the National Space Transportation Policy, issued by the White House in 1994, and will accelerate the development of new launch technologies and concepts to contribute to the continuing commercialization of the national space launch industry.

NASA's Office of Space Access and Technology, Washington, DC, manages the Reusable Launch Vehicle technology program. The Marshall Space Flight Center, Huntsville, AL, is the host center for the X-34 program.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Donald Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

March 31, 1995

Tammy Jones
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-5566)

Ray Villard
Space Telescope Science Institute, Baltimore, MD
(Phone: 410/338-4562)

RELEASE: 95-41

HUBBLE DATA SUGGEST GALAXIES HAVE GIANT HALOS

NASA's Hubble Space Telescope has helped solve a two-decade old cosmic mystery by showing that mysterious clouds of hydrogen in space may actually be vast halos of gas surrounding galaxies.

"This conclusion runs contrary to the long-standing belief that these clouds occur in intergalactic space," says Ken Lanzetta of the State University of New York at Stony Brook.

The existence of such vast halos, which extend 20 times farther than the diameter of a galaxy, might provide new insights into the evolution of galaxies and the nature of dark matter -- an apparently invisible form of matter that surrounds galaxies.

The possibility of galaxy halos was first proposed in 1969 by John Bahcall and Lyman Spitzer of the Institute for Advanced Study, Princeton, NJ. Previous observations with ground-based telescopes, the International Ultraviolet Explorer satellite, and Hubble have suggested that these clouds might be galaxy halos. However, the latest results are the most definitive finding yet, says Lanzetta, because they come from a large sample of 46 galaxies.

For the past two decades, observations with ground-based telescopes have shown that the light from distant quasars (the bright cores of active galaxies) is affected by intervening gas clouds. These clouds are invisible, but betray their presence by absorbing certain frequencies, or colors, of a quasar's light. When a quasar's light is spread out into a spectrum, the missing wavelengths appear as a complex "thicket" of absorption features. Ground-based observations also showed that the number of these clouds rapidly rises out to greater distances.

- more -

However, in 1991, independent observations made with Hubble's Faint Object Spectrograph and Goddard High Resolution Spectrograph instruments detected more than a dozen hydrogen clouds within less than a billion light-years of our galaxy. These clouds could not be detected previously because they are only visible in the ultraviolet part of the spectrum, which is inaccessible with ground-based telescopes. This gave astronomers a powerful opportunity to further test the halo theory by imaging nearby galaxies and attempting to match them with nearby clouds.

Lanzetta, David Bowen of the Space Telescope Science Institute, Baltimore, MD, David Tyler of the University of California at San Diego, and John Webb of the University of New South Wales, Australia, attempted to match galaxies and clouds by first collecting Hubble archival data on six quasars. Next, using telescopes at The National Optical Astronomy Observatory, the Anglo Australian Observatory, the Lick Observatory and the Isaac Newton Telescope, they identified galaxies near the clouds and measured distances. In the majority of cases they found galaxies within about 500,000 light-years of the clouds.

The results explain why so many clouds are seen at greater distances: the light from distant quasars was more likely to pass through a galaxy's halo because the halo is so large.

The Space Telescope Science Institute is operated by AURA (the Association of Universities for Research in Astronomy, Inc.) for NASA, under contract with the Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency.

- end -